Chapter 5

Route Classification

This chapter describes how to perform the technical aspects of a route recon. Route classification is a tool that helps determine what can travel down a road network and how fast it may travel. Routes are reconned, and the results are displayed on map overlays. During war or military operations other than war (MOOTW), only the necessary and essential facts about a route are gathered as quickly and safely as possible. (This information is placed on a route-classification overlay and supplemented by additional reports.) During peacetime operations, detailed route-classification missions are performed to obtain in-depth information for future use.

Route classification may be conducted in a high-threat environment. The same tenets that guide tactical recons apply to technical recons. All recons must be coordinated with the supported unit. Combined-arms support should be planned and rehearsed to support the recon.

The first step in understanding the technical portions of a route recon is understanding what information is needed to complete a route-classification overlay.

ROUTE-CLASSIFICATION OVERLAY

A route-classification overlay graphically depicts a route's entire network of roads, bridge sites, and so forth. (These items are reconned, and the data recorded as support documentation for the complete route.) A route classification gives specific details on what obstructions will slow down a convoy or maneuver force along a route. Engineers are the experts on route classification.

As a minimum, the following information will be included on the route-classification overlay (see Figure 5-1, page 5-2):

- The route-classification formula.
- The name, rank, and social security number (SSN) of the person in charge of performing the classification.
- The unit conducting the classification.
- The date-time group (DTG) that the classification was conducted.
- The map name, edition, and scale.
- Any remarks necessary to ensure complete understanding of the information on the overlay.

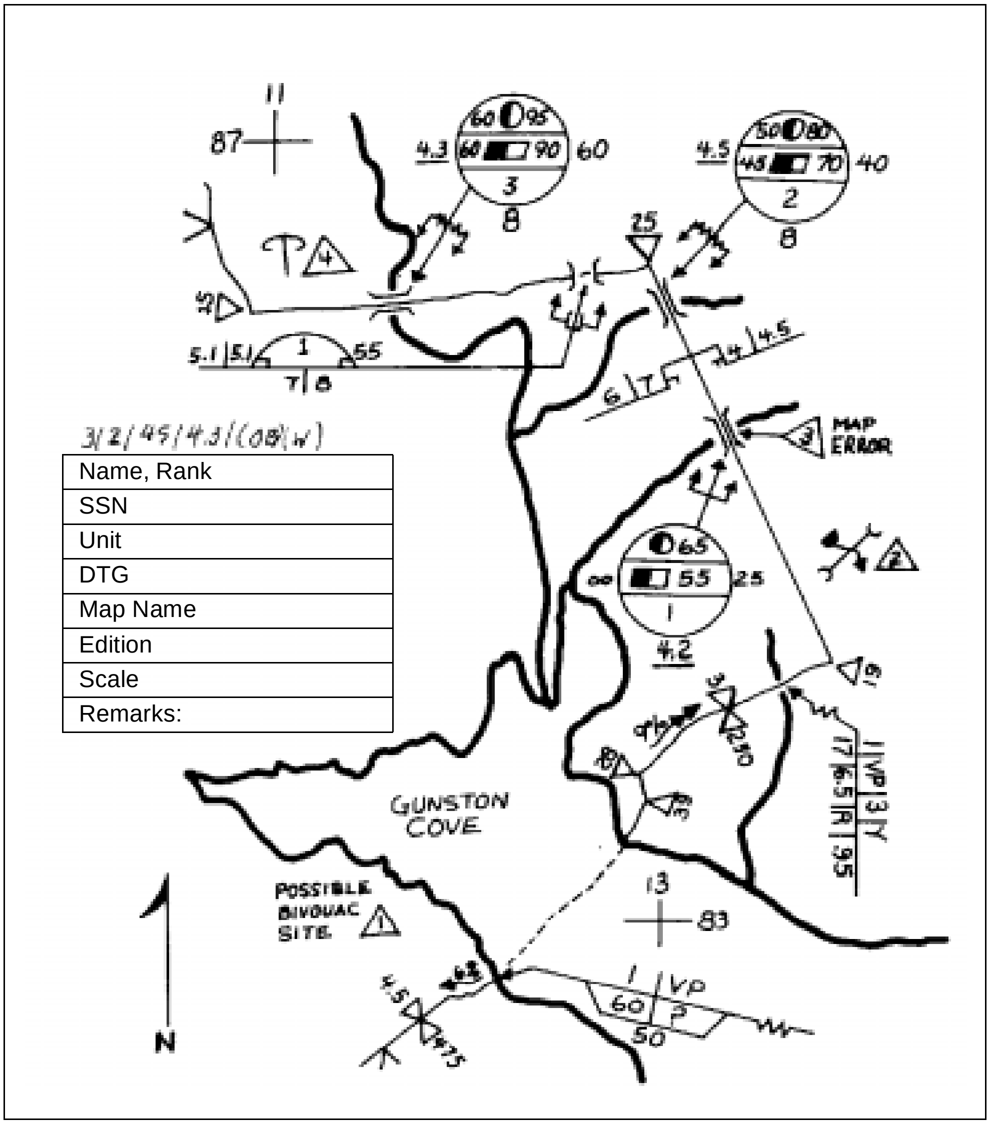


Figure 5-1. Route-classification overlay

ROUTE-CLASSIFICATION FORMULA

A route classification must include every alternate road on which movement can be made and what type of vehicle and traffic load that specific portion of the route can handle. Routes are classified by obtaining all pertinent information concerning trafficability and applying it to the route-classification formula. DA Forms 1248, 1249, 1250, 1251, and 1252 are designed to help organize recon data. These forms are covered in greater detail later in this chapter. The route-classification formula is derived from the information gathered during the route recon. The formula is recorded on the route-classification overlay (see Figure 5-1) and consists of the following:

(1) Route width, in meters.

(2) Route type (based on ability to withstand weather).

(3) Lowest military load classification (MLC).

(4) Lowest overhead clearance, in meters.

(5) Obstructions to traffic flow (OB), if applicable.

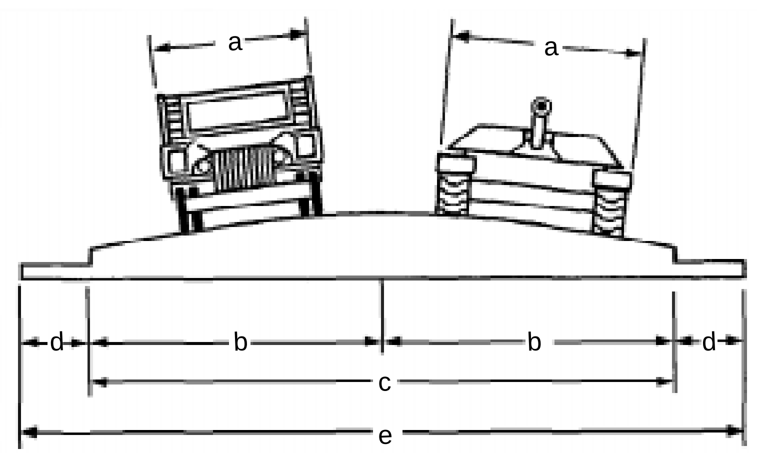
(6) Special conditions, such as snow blockage (T) or flooding (W).

Example: 5.5 / Y / 30 / 4.6 (OB) (T or W)

(1) (2) (3) (4) (5) (6)

Route Width

The route width is the narrowest width of traveled way on a route (see Figure 5-2). This narrow width may be the width of a bridge, a tunnel, a road, an underpass, or other constriction that limits the traveled-way width. The number of lanes is determined by the traveled-way width. The lane width normally required for wheeled vehicles is 3.5 meters; for tracked vehicles it is 4.0 meters.



a = Width of vehicle
b = Width of lane
c = Width of traveled way
d = Width of hard shoulder
e = Width of grading

Figure 5-2. Route widths

According to the number of lanes, a road or route can be classified as follows:

- **Limited access**—Permits passage of isolated vehicles of appropriate width in one direction only.
- **Single lane**—Permits use in only one direction at any one time. Passing or movement in the opposite direction is impossible.
- **Single flow—**Permits the passage of a column of vehicles and allows isolated vehicles to pass or travel in the opposite direction at

predetermined points. It is preferable that such a route be at least 1.5 lanes wide.

- **Double flow—**Permits two columns of vehicles to proceed simultaneously. Such a route must be at least two lanes wide.

Route Type

The route type is determined by its ability to withstand weather. It is determined by the worst section of road on the entire route and is categorized as follows:

- **Type X**—An all-weather route that, with reasonable maintenance, is passable throughout the year to a volume of traffic never appreciably less than its maximum capacity. This type of route is normally formed of roads having waterproof surfaces and being only slightly affected by rain, frost, thaw, or heat. This type of route is never closed because of weather effects other than snow or flood blockage.
- **Type Y**—A limited, all-weather route that, with reasonable maintenance, is passable throughout the year but at times having a volume of traffic considerably less than maximum capacity. This type of route is normally formed of roads that do not have waterproof surfaces and are considerably affected by rain, frost, thaw, or heat. This type of route is closed for short periods (up to one day at a time) by adverse weather conditions during which heavy use of the road would probably lead to complete collapse.
- **Type Z**—A fair-weather route passable only in fair weather. This type of route is so seriously affected by adverse weather conditions that it may remain closed for long periods. Improvement of such a route can only be achieved by construction or realignment.

Military Load Classification

A route's MLC is a class number representing the safe load-carrying capacity and indicating the maximum vehicle class that can be accepted under normal conditions. Usually, the lowest bridge MLC (regardless of the vehicle type or conditions of traffic flow) determines the route's MLC. If there is not a bridge on the route, the worst section of road will determine the route's overall classification.

In cases where vehicles have a higher MLC than the route, an alternate route may be sought or an additional recon of the roads within the route may be necessary to determine whether a change in traffic flow (such as single-flow crossing of a weak point) will permit heavier vehicles on the route. When possible, ensure that the route network includes a number of heavy-traffic roads, as well as average-traffic roads. This helps staff planners manage heavy-traffic loads to decrease the bottleneck effect.

The entire network's class is determined by the minimum load classification of a road or a bridge within the network. These are the broad categories:

- Class 50—average-traffic route.
- Class 80—heavy-traffic route.

- Class 120—very heavy-traffic route.

Overhead Clearance

The lowest overhead clearance is the vertical distance between the road surface and any overhead obstacle (power lines, overpasses, tunnels, and so forth) that denies the use of the road to some vehicles. Use the infinity symbol (∞) for unlimited clearance in the route-classification formula. (Points along the route where the minimum overhead clearance is less than 4.3 meters are considered to be an obstruction.)

Route Obstructions

Route obstructions restrict the type, amount, or speed of traffic flow. They are indicated in the route-classification formula by the abbreviation “OB.” If an obstruction is encountered, its exact nature must be depicted on the route-classification overlay. Obstructions include—

- Overhead obstructions such as tunnels, underpasses, overhead wires, and overhanging buildings with a clearance of less than 4.3 meters.
- Reductions in traveled-way widths that are below the standard minimums prescribed for the type of traffic flow (see Table 5-1). This includes reductions caused by bridges, tunnels, craters, lanes through mined areas, projecting buildings, or rubble.
- Slopes (gradients) of 7 percent or greater.
- Curves with a radius of 25 meters and less. Curves with a radius of 25.1 to 45 meters are not considered to be an obstruction; however, they must be recorded on the route-recon overlay.
- Ferries.
- Fords.

Table 5-1. Traffic-flow capability based on route width

	Limited Access	Single Lane	Single Flow	Double Flow
Wheeled	At least 3.5 m	3.5 to 5.5 m	5.5 to 7.3 m	Over 7.3 m
Tracked and combination vehicles	At least 4.0 m	4.0 to 6.0 m	6.0 to 8.0 m	Over 8 m

Snow Blockage and Flooding

In cases where snow blockage is serious and is blocking traffic on a regular and recurrent basis, the symbol following the route-classification formula is “T.” In cases where flooding is serious and is blocking traffic on a regular and recurrent basis, the symbol following the route-classification formula is “W.”

EXAMPLES OF THE ROUTE-CLASSIFICATION FORMULA

The following are examples depicting the use of the route-classification formula:

- **6.1m/Z/40**/∞—A fair-weather route (Z) with a minimum traveled way of 6.1 meters, and an MLC of 40. Overhead clearance is unlimited (∞) and there are no obstructions to traffic flow. This route, based on its minimum traveled-way width, accommodates both wheeled and tracked, single-flow traffic without obstruction.

- **6.1m/Z/40/∞ (OB)**—A fair-weather route (Z) similar to the previous example, except there is an obstruction. This obstruction could consist of overhead clearances of less than 4.3 meters, grades of 7 percent or greater, curves with a radius of 25 meters and less, or fords and ferries. A traveled way of 6.1 meters limits this route to one-way traffic without a width obstruction. If the route is used for double-flow traffic, then 6.1 meters of traveled way is considered an obstruction and is indicated in the formula as an obstruction.
- **7m/Y/50/4.6 (OB)**—A limited, all-weather route (Y) with a minimum traveled way of 7 meters, an MLC of 50, an overhead clearance of 4.6 meters, and an obstruction. This route width is not suitable for double-flow traffic (wheeled or tracked). This width constriction is indicated as OB in the route-classification formula if the route is used for double-flow traffic.
- **10.5m/X/120/∞ (OB) (W)**—An all-weather route (X) with a minimum traveled-way width of 10.5 meters, which is suitable for two-way traffic of both wheeled and tracked vehicles; an MLC of 120; unlimited overhead clearance; an obstruction; and regular, recurrent flooding.

CURVE CALCULATIONS

The speed at which vehicles move along a route is affected by sharp curves. Curves with a radius of 25 meters and less are obstructions to traffic and are indicated by the abbreviation “OB” in the route-classification formula and identified on DA Form 1248. Curves with a radius between 25.1 and 45 meters are recorded on the overlay but are not considered obstructions.

MEASURING METHODS

There are several ways to measure curves: the tape-measure, triangulation, and formula methods.

Tape-Measure Method

A quick way to estimate the radius of a sharp curve is by using a tape measure to find the radius (see Figure 5-3). Imagine the outer edge of the curve as the outer edge of a circle. Find (estimate) the center of this imaginary circle; then measure the radius using a tape measure. Start from the center of the circle and measure to the outside edge of the curve. The length of the tape measure from the center of the imaginary circle to its outer edge is the curve’s radius. This method is practical for curves located on relatively flat ground and having a radius up to 15 meters.

Triangulation Method

You can determine a curve’s approximate radius by “laying out” right triangles (3:4:5 proportion) at the point of curvature (PC) and point of tangency (PT) locations (see Figure 5-4). The intersection (o), which is formed by extending the legs of each triangle, represents the center of the circle. The distance (R) from point o to either point PC or PT represents the curve’s radius.

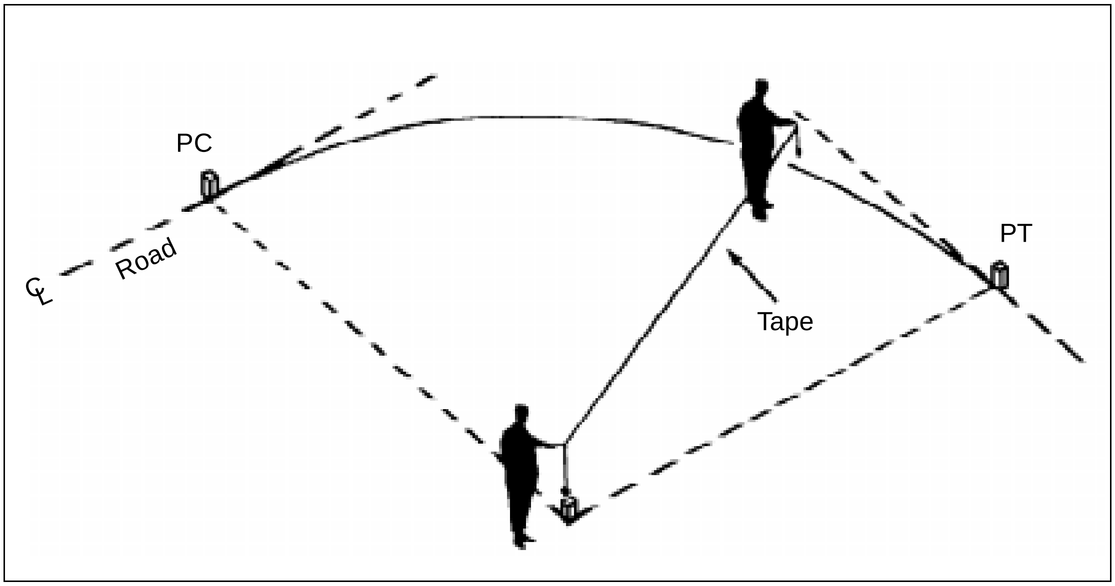


Figure 5-3. Tape-measure method

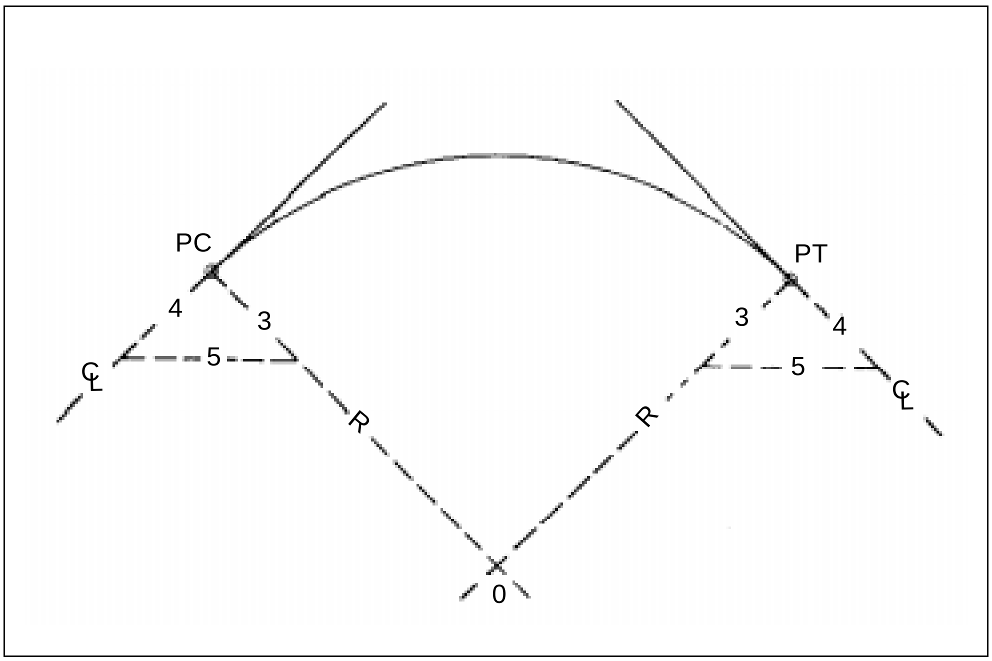


Figure 5-4. Triangulation method

Formula Method

Another method of determining the curve's radius (see Figure 5-5) is based on the formula (all measurements are in meters)—

$$R = (C^2/8M) + (M/2)$$

where—

R = *radius of curve*

C = *distance from the centerline of the road to the centerline of the road at the outer extremities of the curve*

M = *perpendicular distance from the center of the tape to the centerline of the road*

NOTE: When conditions warrant, set M at 2 meters from the centerline, then measure C 2 meters from the centerline. Use this method when there is a time limitation or because natural or man-made restrictions prevent proper measurements.

Example: If C is 15 meters and M is fixed at 2 meters, the formula becomes—

$$R = (15^2/16) + 2/2$$

The result of this calculation would be an obstruction to traffic flow, and "OB" would be placed in the route-classification formula.

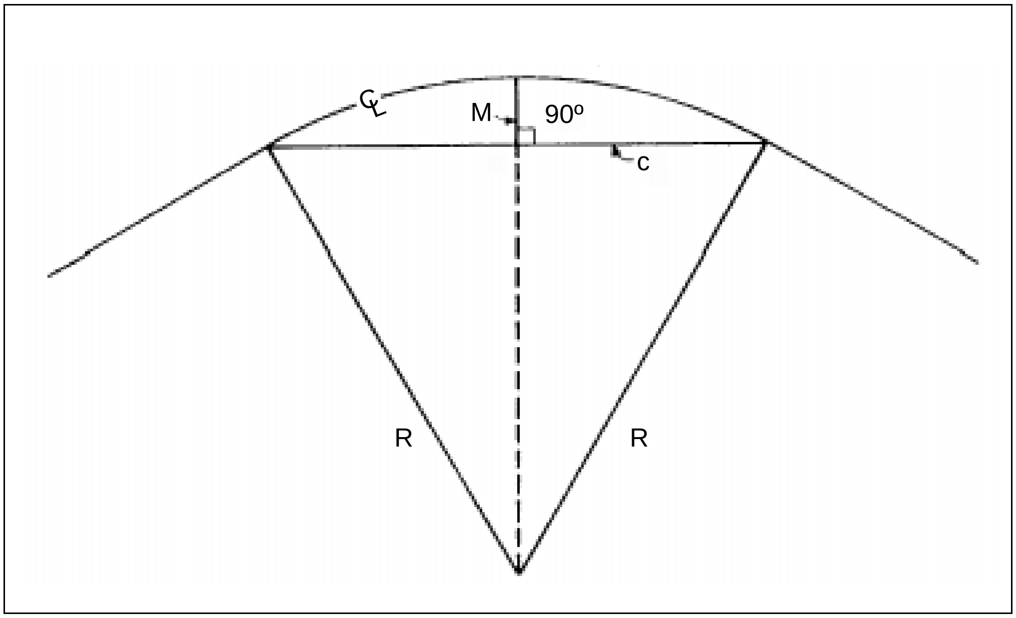


Figure 5-5. Formula method

CURVE SYMBOL

Sharp curves with a radius of 45 meters or less are symbolically represented on maps or overlays by a triangle that points to the curve's exact map location. In addition, the measured value (in meters) for the radius of curvature is written outside the triangle (see Figure 5-6). All curves with a radius of 45 meters are reportable and need to be noted on DA Form 1248.

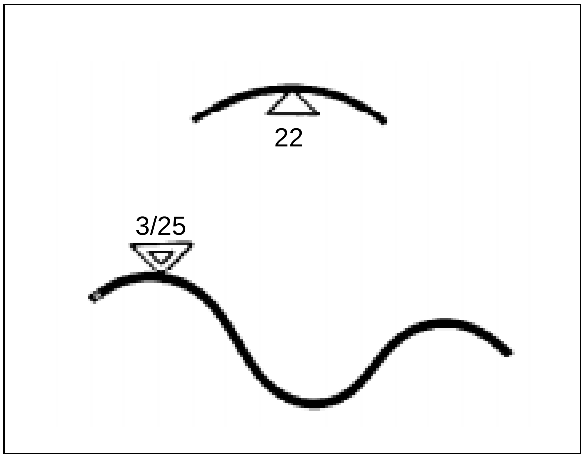


Figure 5-6. Curve symbols

SERIES OF SHARP CURVES

A series of sharp curves is represented by two triangles, one drawn inside the other. The outer triangle points to the location of the first curve. The number of curves and the radius of curvature for the sharpest curve of the series are written to the outside of the triangle (see Figure 5-6).

SLOPE ESTIMATION

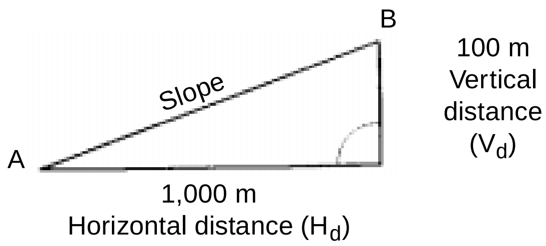
The rise and fall of the ground is known as the slope or gradient (grade). Slopes of 7 percent or greater affect the movement speed along a route and are considered an obstruction. The percent of slope is used to describe the effect that inclines have on movement rates. It is the ratio of the change in elevation (the vertical distance to the horizontal ground distance) multiplied by 100 (see Figure 5-7, page 5-10). It is important to express the vertical distance and the horizontal in the same unit of measure. Report all slopes greater then 5 percent on the route-classification overlay.

PERCENT OF SLOPE

The following methods are used for determining the percent of slope:

Clinometer Method

A clinometer is an instrument that directly measures percent of slope. It can be found in engineer survey units, as part of an artillery compass, and as part of an engineer platoon sketch set. Follow the instructions included with the instrument.



$$\text{Percent of slope} = \frac{V_d}{H_d} \times 100 = \frac{100\ m}{1{,}000\ m} \times 100 = +10\%$$

Figure 5-7. Percent-of-slope formula

Map Method

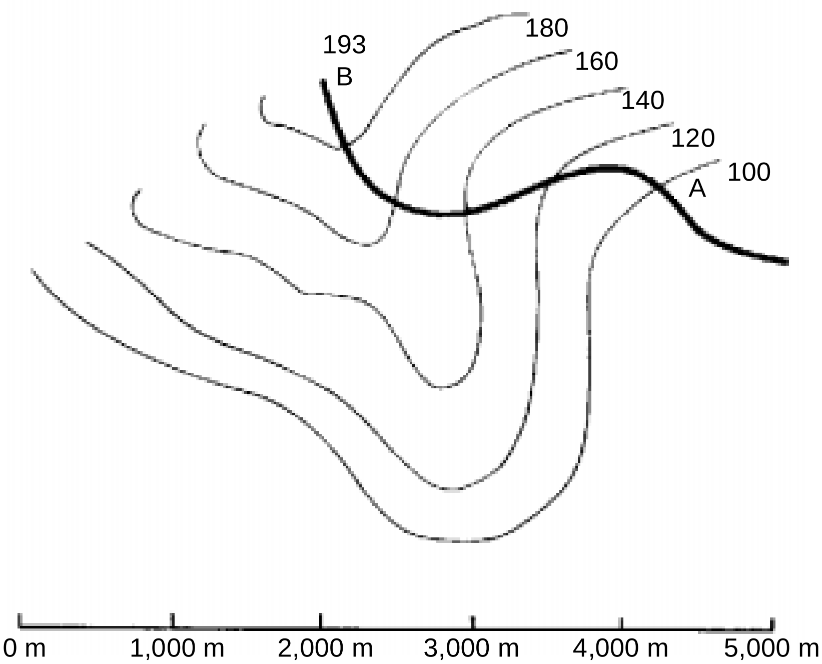
Use a large-scale map (such as 1:50,000) to estimate the percent of slope quickly. After identifying the slope on the map, find the difference in elevations between the top and bottom of the slope by reading the elevation contours or spot elevation. Then, measure and convert the horizontal distance (usually road distance) to the same unit of measurement as the elevation difference. Substitute the vertical and horizontal distances in the percent-of-slope formula and compute the percent of slope (see Figure 5-8).

Pace Method

The pace method is a quick way to estimate percent of slope. Determine, accurately, the height and pace of each soldier for each member of a recon team before using this method. As a rule of thumb, the eye level of the average soldier is 1.75 meters above the ground. The pace of the average soldier is 0.75 meter.

Perform the following procedures for the pace method:

- Stand at the bottom of the slope with head and eyes level.
- Sight a spot on the slope. This spot should be easily identifiable. If it is not, another member of the team should go forward to mark the location.
- Walk forward and stand on the marked spot. Record the number of paces. Repeat this procedure until you reach the top of the slope (estimate fractions of an eye level).
- Compute the vertical distance by multiplying the number of sightings by the eye-level height (1.75 meters). Compute the horizontal distance by totaling the number of paces and converting them to meters by multiplying by 0.75 (or the known pace-to-meter conversion factor).



Find the difference in elevation (V_d)

Spot elevation B	=	193 m
Spot elevation A	=	100 m
Difference in elevation (V_d)	=	93 m

Find the horizontal distance (H_d)

Road distance A to B (use a piece of paper and graphic scale as shown in FM 21-26) = 3,720 m

Use the percent-of-slope formula.

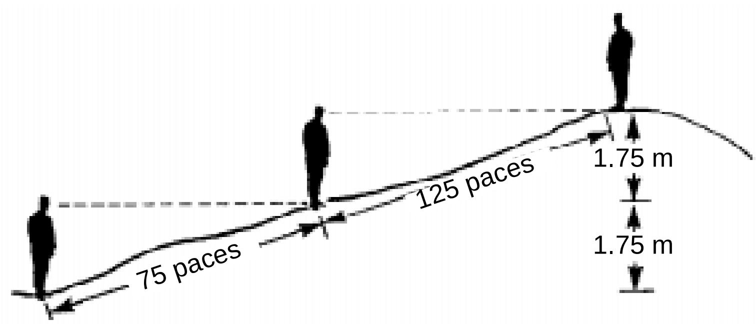
$$\frac{V_d}{H_d} \times 100$$

$$= \frac{93}{3,720} \times 100$$

$$= +2.5\%$$

Figure 5-8. Map method to determine percent of slope

- Calculate the percent of slope by substituting the values into the percent-of-slope formula (see Figure 5-9). Because this method considers horizontal ground distance and incline distance as equal, you can obtain reasonable accuracy only for slopes less than 30 percent. This method requires practice to achieve acceptable accuracy. A line level and string can be used to train this method.



Find:	Percent of slope	=	
Given:	Eye-level height	=	1.75 m
	Pace	=	.75 m
Answer:	Vertical distance	=	2 x 1.75 m
		=	3.5 m
	Horizontal distance	=	(75 paces + 125 paces x .75
		=	150 m

$$\text{Percent of slope} = \frac{V_d}{H_d} \times 100$$

$$= \frac{3.50}{\;} \times 100$$

Figure 5-9. Pace method to determine percent of slope

Angle-of-Slope Method

The angle-of-slope method is a quick way to estimate the percent of slope. The angle of slope is first measured by using an elevation quadrant, an aiming circle, an M2 compass, or binoculars with a standard reticle. If the instrument used to take the angle of measurement is mounted above ground level, the height difference must be compensated for by sighting above the slope a corresponding, equal distance. (The corresponding distance is the distance the instrument is above the ground.) You must conduct the angle of measurement at the base of the slope. Once you obtain the angle of measurement, refer to

Table 5-2 and enter the column corresponding to the measured angle of slope. You can read the percent of slope directly from Table 5-2 (see Figure 5-10).

Table 5-2. Conversion of degrees and mils to percent of slope

Degrees of Slope	Mils of Slope	Percent of Slope
1	18	1.7
2	36	3.5
3	53	5.2
4	71	7.0
5	89	8.7
10	175	17.6
15	267	26.7
20	356	36.4
25	444	46.6
30	533	57.7
35	622	70.0
40	711	83.9
45	800	100.0
50	889	108.7
55	978	117.6
60	1,067	126.7

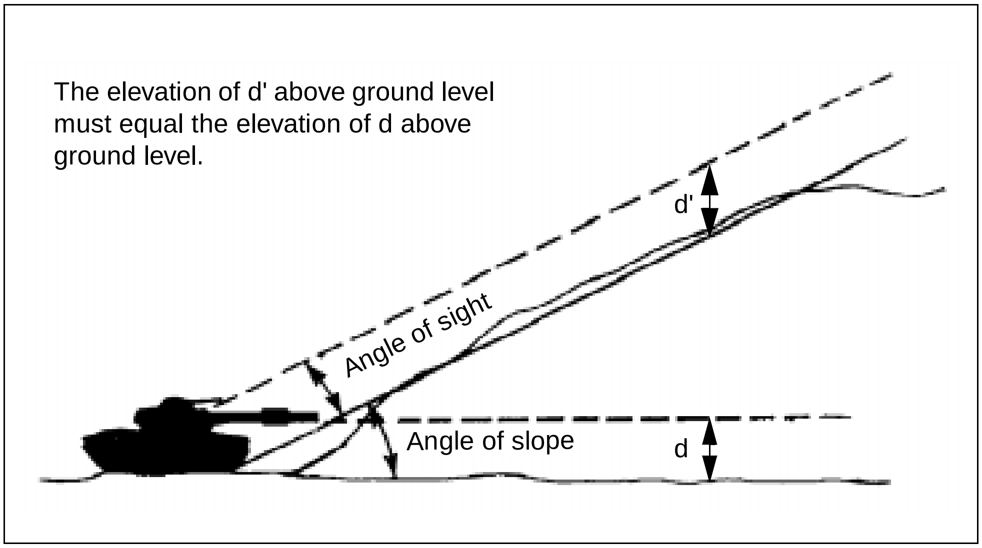


Figure 5-10. Angle-of-slope method to determine percent of slope

SLOPE SYMBOL

Most vehicles negotiating slopes of 7 percent or greater for a significant distance will be slowed. Such slope characteristics must be accurately reported. The symbols illustrated in Figure 5-11, page 5-14, are used to represent various slopes.

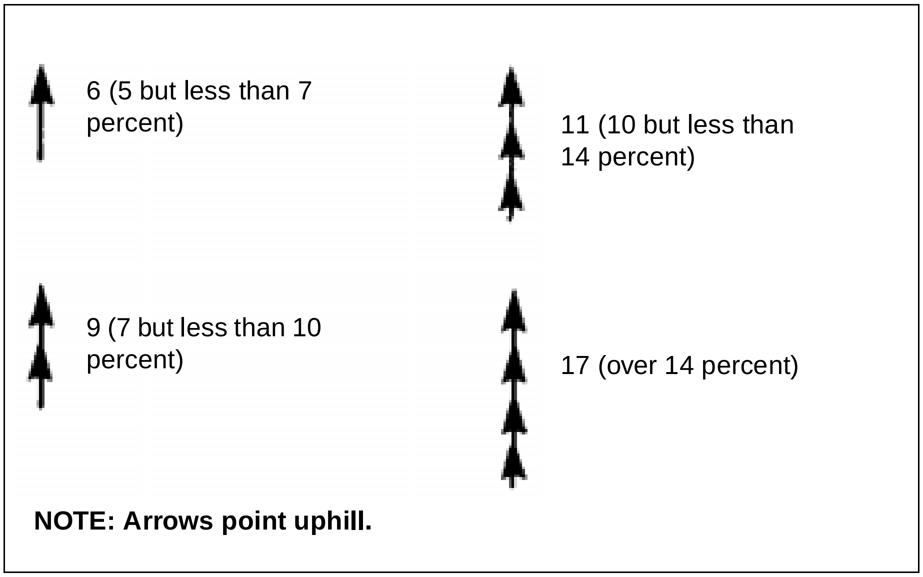


Figure 5-11. Percent-of-slope symbols

DESCRIPTION OF SLOPE SYMBOLS

A single arrowhead along the trace of a route pointing in the uphill direction indicates a grade of at least 5 but less than 7 percent. Two arrowheads represent a grade of at least 7 but less than 10 percent. Three arrowheads represent a grade of at least 10 but less than 14 percent. Four arrowheads represent a grade of 14 percent or more. A symbol is not required for slopes less than 5 percent.

The percent of slope is written to the right of the arrow. When the map scale permits, the length of the arrow shaft will be drawn to map scale to represent the approximate length of the grade.

NOTE: Slopes of 7 percent or greater are obstructions to traffic flow and are indicated by the abbreviation “OB” in the route-classification formula.

CONSTRICTIONS

Reductions in traveled-way widths (constrictions) include narrow streets in built-up areas, drainage ditches, embankments, and war damage. These constrictions may limit vehicle movement; therefore, the physical dimensions of the vehicles that will be using the route must be known and considered when conducting the route classification.

Constrictions in the traveled-way width below minimum requirements are depicted on maps and overlays by two opposing shaded triangles. The width of the usable traveled way (in meters) is written next to the left triangle. The length of the constriction (in meters) is written next to the right triangle (see Figure 5-12).

NOTE: Constrictions of traveled-way widths below the minimum standard for the type and flow of traffic are obstructions and are indicated by the symbol “OB” in the route-classification formula.

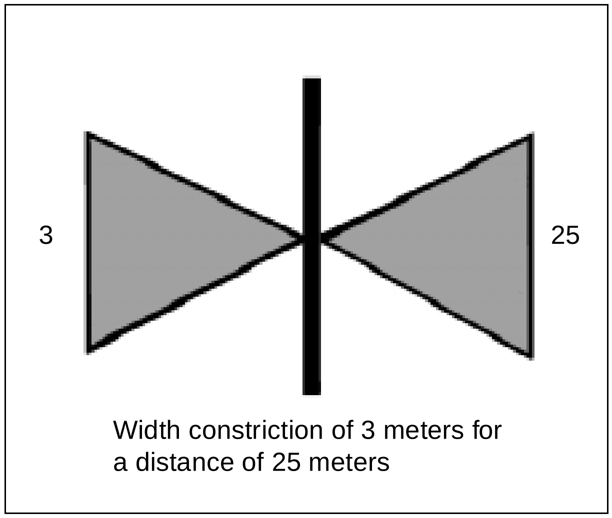


Figure 5-12. Route-constriction symbol

UNDERPASSES

An underpass is depicted on a map or overlay by a symbol that shows the structure's ceiling. It is drawn over the route at the map location. The width (in meters) is written to the left of the underpass symbol, and the overhead clearance (in meters) is written to the right of the underpass symbol (see Figure 5-13).

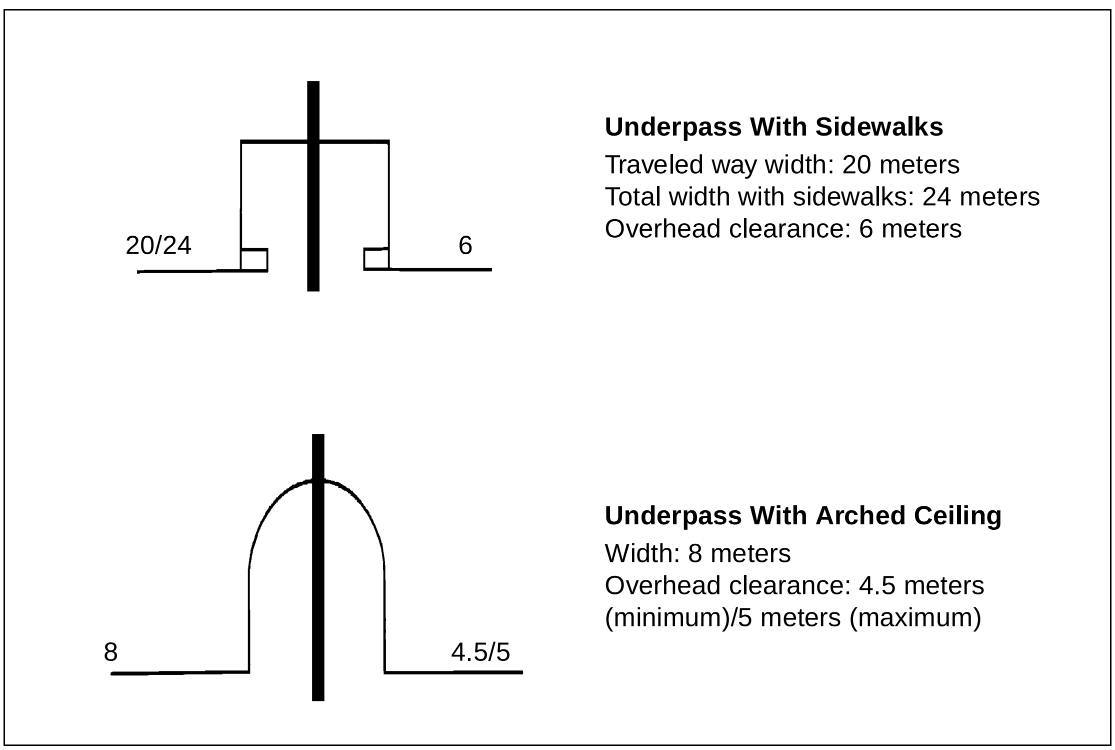


Figure 5-13. Underpass symbols

If sidewalks permit emergency passage of wider vehicles, the sidewalks are symbolically represented. This information should be noted on DA Form 1250. The traveled-way width is recorded first, followed by a slash, then the structure's total width, including sidewalks.

NOTE: Items such as arched ceilings or irregularities in ceilings that result in a decrease in overhead clearance must be noted. In such cases, an extension of width may not mean that the structure will accommodate wider vehicles.

Both minimum and maximum overhead clearances, if different, will be recorded. The minimum will be recorded first, followed by a slash, then the maximum overhead clearance.

TUNNELS

A tunnel is an artificially covered (such as a covered bridge or a snowshed) or underground section of road along a route. A tunnel recon determines essential information such as the serial number, location, type, length, width (including sidewalks), bypasses, alignment, gradient, and cross section. A tunnel consists of a bore, a tunnel liner, and a portal. Common shapes of tunnel bores (see Figure 5-14) are semicircular, elliptical, horseshoe, and square with an arched ceiling.

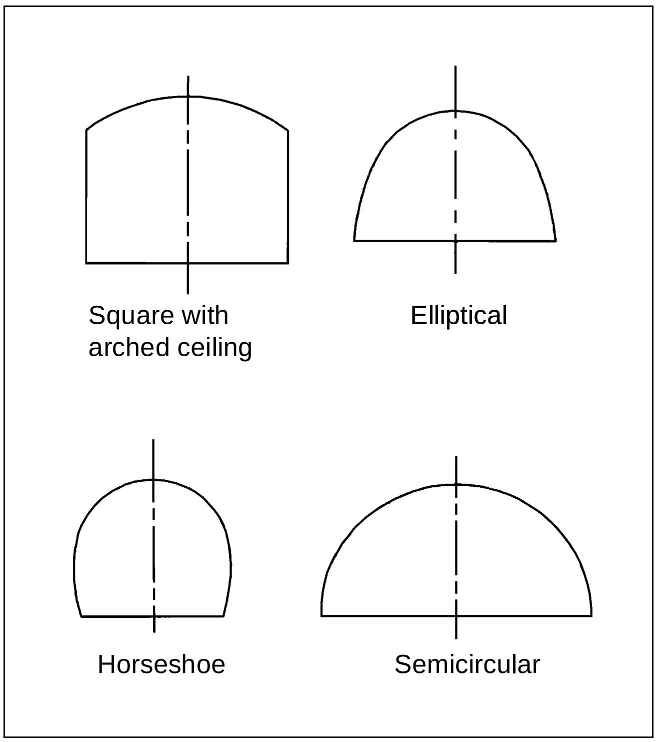
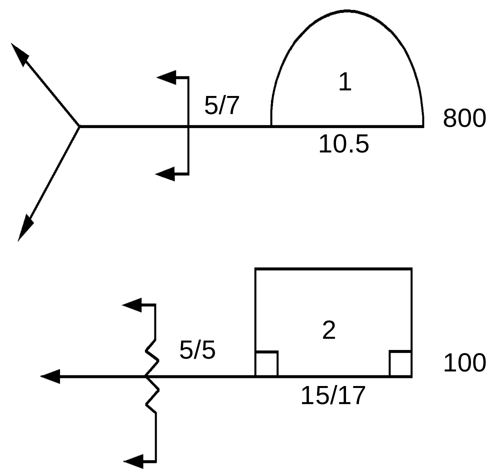


Figure 5-14. Types of tunnel boxes

TUNNEL SYMBOL

Basic tunnel information is recorded on maps or overlays using symbols (see Figure 5-15). The location of the tunnel entrance is shown on a map or overlay by an arrow from the symbol to the location of the entrance. For long tunnels (greater than 30.5 meters), both tunnel entrance locations are indicated.



Tunnel Number 1

Minimum overhead clearance: 5 meters
Maximum overhead clearance: 7 meters
Traveled way: 10.5 meters wide; 800 meters long; easy bypass available

Tunnel Number 2

Minimum overhead clearance: 5 meters
Maximum overhead clearance: 5 meters
Traveled way: 15 meters wide (17 meters total including sidewalks); 100 meters long; difficult bypass available

Figure 5-15. Tunnel symbols

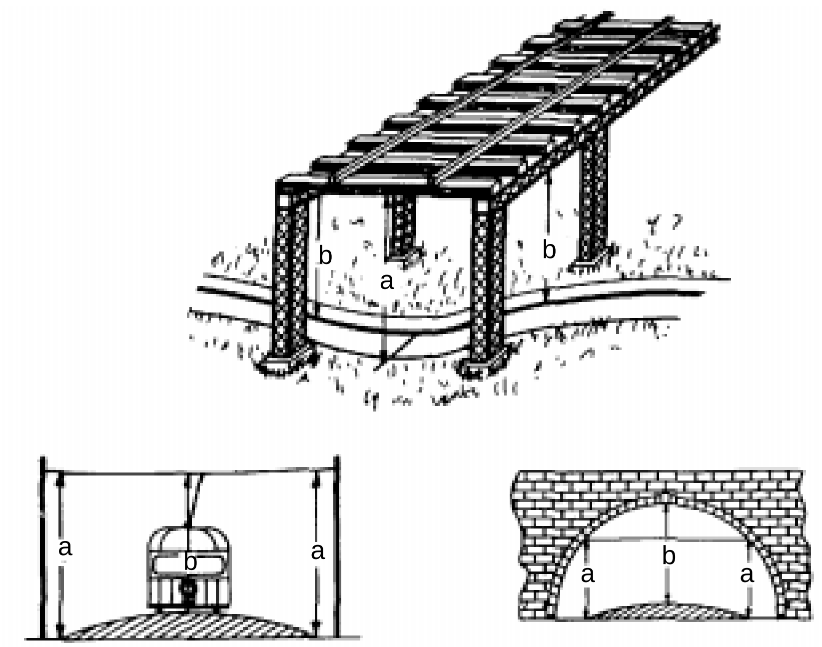
For later reference, a serial number is assigned to each tunnel. (Check for an existing fixed serial number on the actual tunnel or map sheet; if there is not a serial number, assign a number based on the unit's SOP.) Serial numbers are not duplicated on any one map sheet, overlay, or document. The number is recorded inside the symbol. The traveled-way width is shown in meters and is placed below the symbol.

If sidewalks permit the emergency passage of wider vehicles, then the sidewalks are symbolically represented and the traveled-way width is written first, followed by a slash, then the total width including the sidewalks.

NOTE: Structures with arched or irregular ceilings will decrease overhead clearance. An extension of width does not always mean that the structure will accommodate wider vehicles.

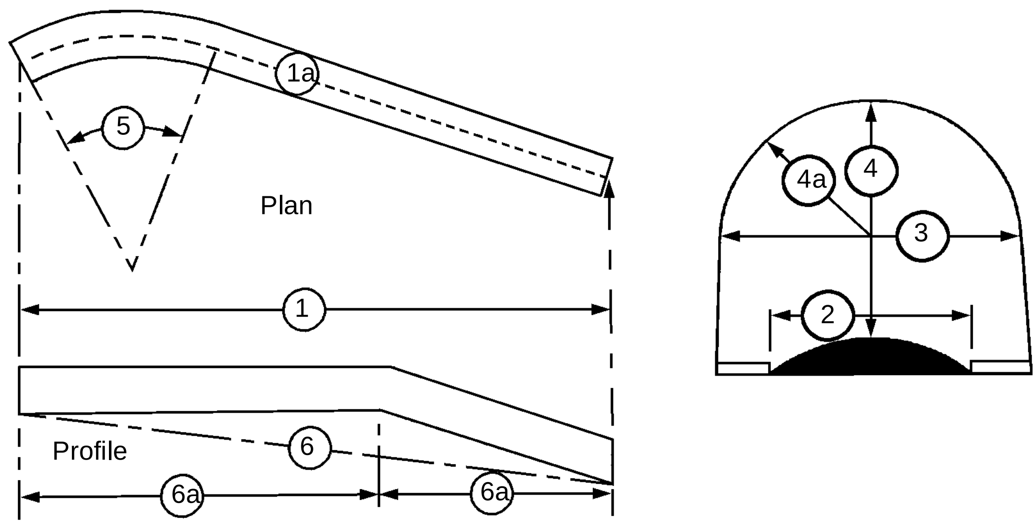
OVERHEAD CLEARANCE

Overhead clearance is the shortest distance between the surface of a traveled way and any obstruction vertically above it. The measurement of overhead clearance must be accurate. Obtain the measurements shown in Figures 5-16 and 5-17 and record them on DA Form 1250.



a - Minimum measurement (always taken at the outside edge of the traveled way)
b - Maximum measurement (always taken at the center of the road)

Figure 5-16. Overhead-clearance measurements



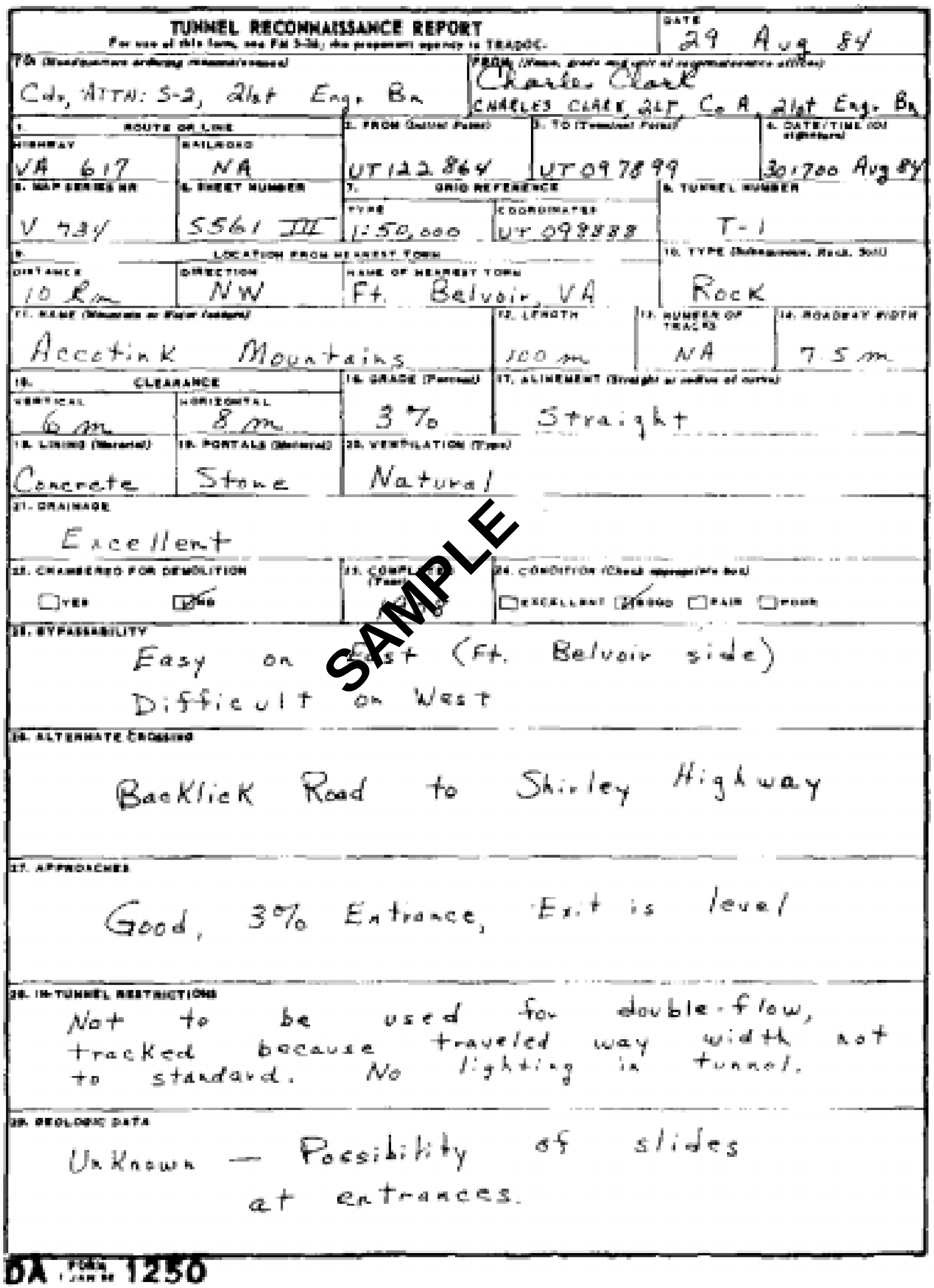
1 - Portal-to-portal length of tunnel
1a - Centerline distance of tunnel
2 - Effective width of the traveled way, curb to curb
3 - Horizontal clearance (minimum width of the tunnel bore measured at least 4 feet above the traveled way
4 - Overhead clearance (minimum distance between the top of the traveled way and the lower edge of the tunnel ceiling or any obstruction below the ceiling, such as trolley wires or electric light wires)
4a - Rise of tunnel arch (radius of curved portion)
5 - Radius of curvature of the traveled way, either measured or estimated
6 - Gradient (percentage of rise of the traveled way between portals)
6a - Change in gradient within the tunnel (percentage of rise each way from break of grade)

Figure 5-17. Dimensions required for tunnels

TUNNEL RECONNAISSANCE REPORT

The following are explanations for sections of DA Form 1250 that are not self-explanatory (see Figures 5-18 through 5-19a, pages 5-21 through 5-23):

- **Block 8.** Record the tunnel number found on the map sheet or on the head wall (or data plate) of the actual tunnel. If there is not a number on the map or tunnel, then assign an appropriate number based on the unit's SOP. If there is a different number on the map than on the tunnel, record both serial numbers.
- **Block 13.** Record the number of railroad tracks passing through the tunnel, if applicable.
- **Block 15.** Record the vertical clearance (the shortest clearance from the road surface in the tunnel to the lowest point on the ceiling above the traveled way). Also, record the distance from the sidewalk to the ceiling if traffic can travel on the sidewalks.
- **Block 15 (continued).** Record the horizontal clearance. It is the roadway width or the roadway width and sidewalks/emergency lanes (where vehicles can move through the tunnel without striking the top or sides).
- **Block 16.** Record the internal tunnel grade. Record the grade of the tunnel entrances in Block 27.
- **Block 17.** State whether the tunnel is straight or curved. Record curves that may restrict traffic flow.
- **Block 19.** Record a description of what the tunnel entrances (portals) look like and their composition.
- **Block 22.** Mark the applicable box. Some tunnels are chambered for demolition. This means that the tunnel has predesigned locations for placing demolitions to destroy the tunnel and deny use by the enemy.
- **Block 23.** Record the date the tunnel was constructed.
- **Block 29.** Inspect the rock or soil at the tunnel's entrances. If there is a chance of a rock or mud slide, record the location and possible solution to the problem.



TUNNEL RECONNAISSANCE REPORT
For use of this form, see FM 5-34; the proponent agency is TRADOC.

DATE: 29 Aug 84

TO: Cdr, ATTN: S-2, 21st Engr Bn

FROM: Charles Clark — CHARLES CLARK, 2LT, Co A, 21st Engr Bn

1. ROUTE OR LINE — HIGHWAY	VA 617
RAILROAD	NA
2. FROM (Initial Point)	UT 122864
3. TO (Terminal Point)	UT 097899
4. DATE/TIME (Of signature)	301700 Aug 84
5. MAP SERIES NR	V 731
6. SHEET NUMBER	5561 III
7. GRID REFERENCE — TYPE	1:50,000
COORDINATES	UT 099888
8. TUNNEL NUMBER	T-1
9. LOCATION FROM NEAREST TOWN — DISTANCE	10 Km
DIRECTION	NW
NAME OF NEAREST TOWN	Ft. Belvoir, VA
10. TYPE (Subaqueous, Rock, Soil)	Rock
11. NAME (Mountain or Major feature)	Accotink Mountains
12. LENGTH	100 m
13. NUMBER OF TRACKS	NA
14. ROADWAY WIDTH	7.5 m
15. CLEARANCE — VERTICAL	6 m
HORIZONTAL	8 m
16. GRADE (Percent)	3 %
17. ALINEMENT (Straight or radius of curve)	Straight
18. LINING (Material)	Concrete
19. PORTALS (Material)	Stone
20. VENTILATION (Type)	Natural
21. DRAINAGE	Excellent
22. CHAMBERED FOR DEMOLITION	☐ YES ☑ NO
23. COMPLETED (Year)	1968
24. CONDITION (Check appropriate box)	☐ EXCELLENT ☑ GOOD ☐ FAIR ☐ POOR
25. BYPASSABILITY	Easy on East (Ft. Belvoir side) Difficult on West
26. ALTERNATE CROSSING	Backlick Road to Shirley Highway
27. APPROACHES	Good, 3% Entrance, Exit is level
28. IN-TUNNEL RESTRICTIONS	Not to be used for double-flow, tracked because traveled way width not to standard. No lighting in tunnel.
29. GEOLOGIC DATA	Unknown — Possibility of slides at entrances.

SAMPLE

DA FORM 1250, 1 JAN 56

Figure 5-18. Sample Tunnel Reconnaissance Report (front)

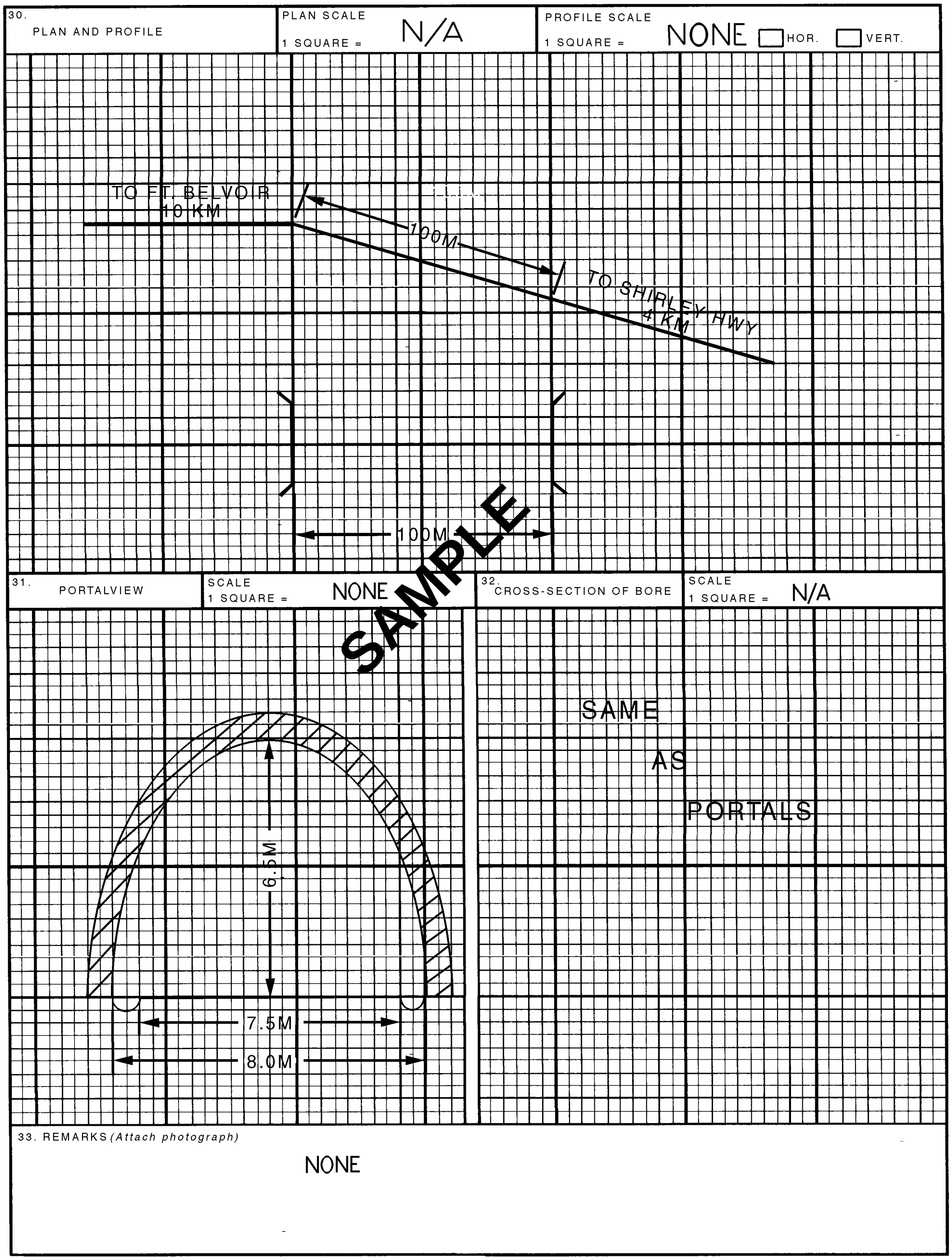


Figure 5-19. Sample Tunnel Reconnaissance Report (back)

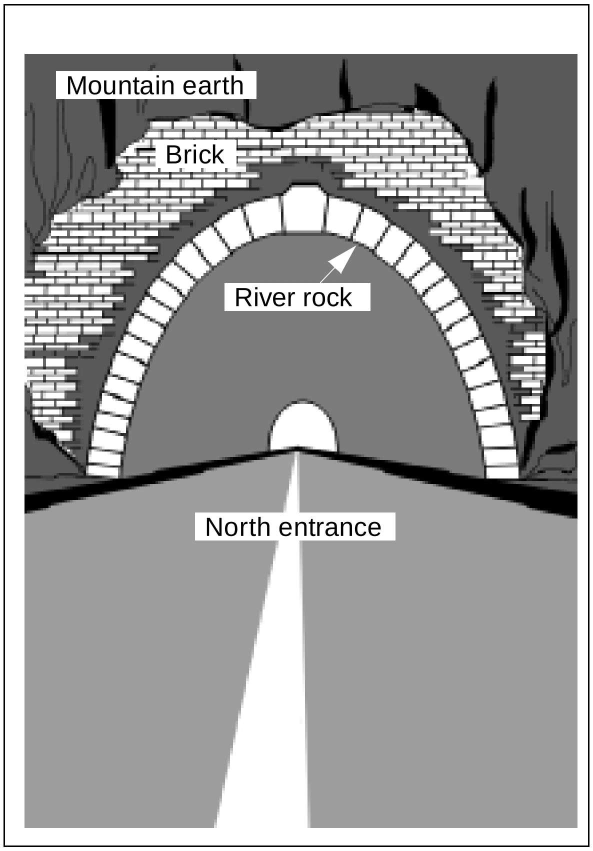
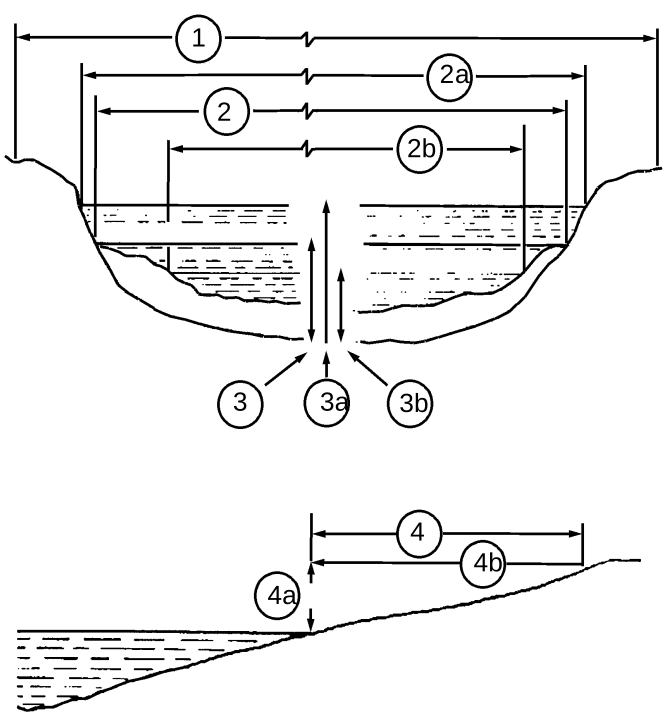


Figure 5-19a. Portal view of tunnel

STREAM RECON

A stream-crossing site is a location at a body of water where vehicles can "swim" across and not touch the bottom. Identify and report locations that permit smooth traffic flow and reduce route obstructions as much as possible. When conducting a recon of a stream-crossing area, record the stream's depth, width, approaches, velocities, and natural and man-made obstacles (see Figure 5-20).



1 - Width of streambed from bank to bank
2 - Actual width of water, measured at normal stage (maximum width 2a and minimum width 2b are estimated, based on local observations or records of high water and low water)
3 - Actual depth of stream at normal water level
3a - Estimated maximum water depth, based on local observations or records
3b - Estimated minimum water depth, based on local observations or records
4 - Slope of approaches (slope of stream banks through which approach roads are cut)

$$\frac{4a}{4b} \times 100$$

Figure 5-20. Dimensions required for streams

MEASUREMENTS

Stream depth is usually measured using field-expedient devices such as poles or weighted ropes. Measure the depth every 3 meters along the planned stream-crossing route. Recheck depths and currents frequently during inclement weather. As a result of sudden, heavy rainfall, a sluggish stream or river may become a torrent very quickly, particularly in tropical and arid regions. Monitor weather reports of the surrounding area. Storms occurring miles away can cause flash flooding. Always consider the importance of upstream dams and locks that may cause elevated levels or flooding when opened or destroyed. **NOTE: The actual depth you measure is recorded as normal depth when there is little time to recon.**

PREEXISTING DATA

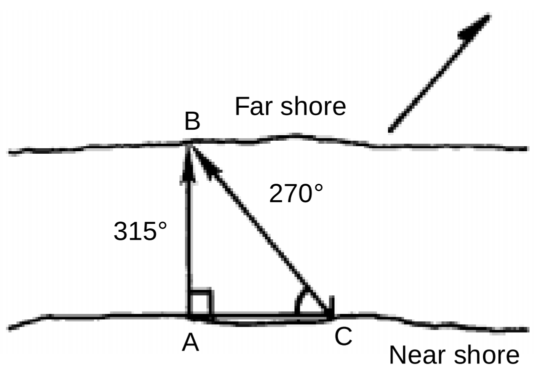
In developed areas of the world, special water-navigation maps containing water-body data are available through government agencies. The S2 can obtain copies of such maps. However, always check the actual site when possible; there is no substitute for an actual recon.

STREAM WIDTH

Determine the stream width by using the compass method; an aiming circle, azimuth indicator, or alidade; or a GPS or by taking a direct measurement.

Compass Method

Determine stream width by using a compass to take an azimuth from a point on the near shore and close to the water's edge to a point on the opposite shore and close to the water's edge (see Figure 5-21). On the near shore, establish another point that is on a line and at a right angle to the azimuth selected. The azimuth to the same point on the far shore is + or - 45 degrees (800 mils) from the previous azimuth. Measure the distance between the two points on the near shore. This distance is equal to the distance across the stream.



A - Point on near shore
B - Point on far shore
AB - Distance to be measured

Azimuth of line AB is 315° (moving left, add 45°; moving right, subtract 45°).

Azimuth of line CB is 270°.

Difference between azimuth AB and azimuth CB is 45°.

Distance along AC equals distance along AB.

Figure 5-21. Measuring stream width with a compass

Aiming Circle, Azimuth Indicator, or Alidade

Use an aiming circle, azimuth indicator, or alidade to measure the angle between two points that are a known distance apart on the near shore and a third point directly across the river from one of these points (see Figure 5-22, page 5-26). Using trigonometric relationships, compute the distance across the stream.

Global Positioning System

Calculate the distance using two known grid points (from the GPS).

Direct Measurement

Measure short gaps with a tape measure or a dark rope that is marked and accurately measured.

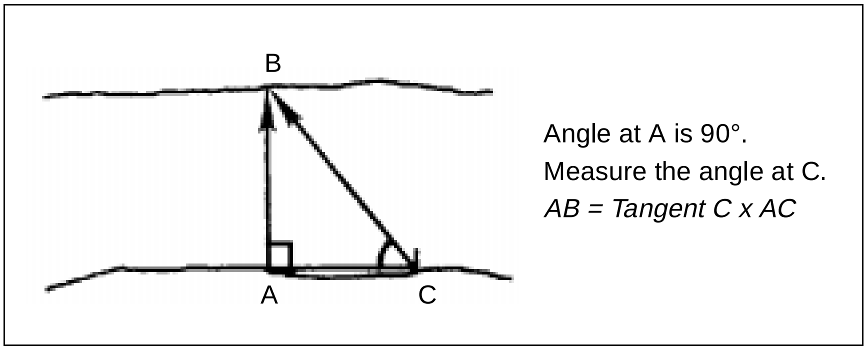


Figure 5-22. Measuring stream width with a surveying instrument

CURRENT VELOCITIES

Current velocities vary in different parts of a stream. Velocity is usually slower near the shore and faster in the main channel. Perform the following procedure to determine stream velocity:

- Measure a distance along a river bank.
- Throw a light floating object (not affected by the wind) into the stream.
- Record the time of travel it takes for the object to travel the measured distance. Repeat the procedure at least three times. Use the average time of the test in the following formula (see Figure 5-23) to determine the stream's velocity:

Stream velocity, in meters per second = measured distance, in meters/ average time, in seconds

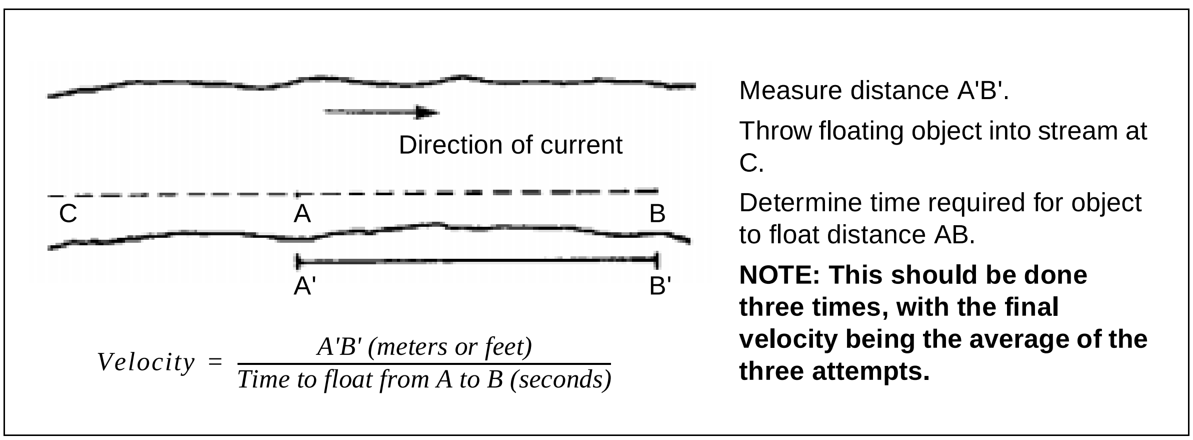


Figure 5-23. Finding stream velocity

STREAM APPROACHES

Gently sloping stream approaches are desirable for fording and swimming operations. Slope is expressed in percent. Ensure that the slope-climbing capability is considered for the vehicles that are expected to ford/swim the stream. This information is found on the vehicle's data plate or dash plate or in the vehicle's technical manual (TM). When considering slope-climbing capability, consider the degrading effects of weather, the condition of the vehicle's tires or tracks, and the condition of the ground surface of both sides of the stream. When bank improvements are necessary, include the amount and type of work on DA Form 1711-R. See Appendix D for further details on engineer reconnaissance and DA Form 1711-R. A blank DA Form 1711-R is provided at the back of this publication; it can be locally reporduced on 8 1/2- by 11-inch paper.

Consider and avoid the following obstacles during stream-crossing operations:

- High, vertical banks.
- Mines and booby traps that are located at the entrance and exit or at likely approaches, submerged, or attached to poles and floating logs.
- Debris and floating objects such as logs and brush, poles, or floating logs with wire attached (which will foul propellers and suspension systems).
- Ice crusts.

FORDS

A ford is a location in a water barrier where the current, bottom, and approaches allow personnel and vehicles and other equipment to cross and remain in contact with the bottom during crossing. Fords are obstructions to traffic flow and are shown by the abbreviation "OB" in the route-classification formula (detailed information is recorded on DA Form 1251).

During high-water periods, low-water bridges are easily confused with paved fords because both are completely submerged. It is important to know the difference between this type of bridge and a paved ford because of corresponding military load limitations.

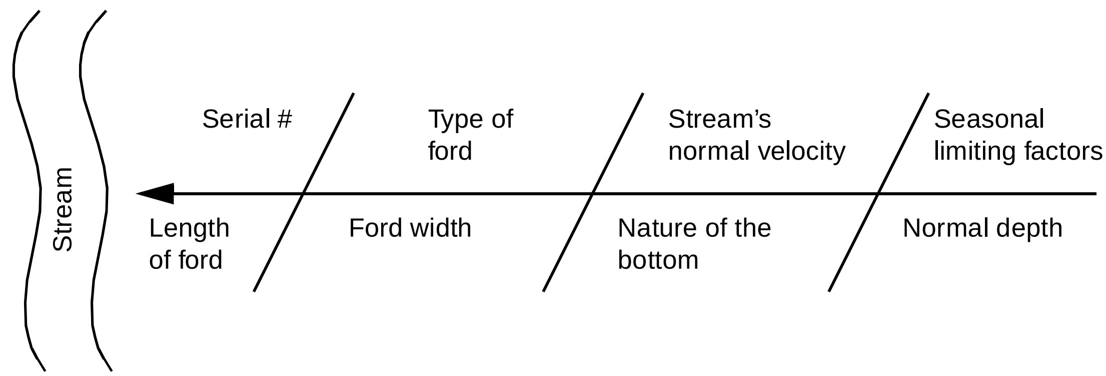
Fords are classified according to their crossing potential (or trafficability) for pedestrians or vehicles. Fordable depths for vehicular traffic can be increased by suitable waterproofing and adding deep-water fording kits. These kits permit fording depths up to an average of 4.3 meters. Check vehicle TMs for further fording information.

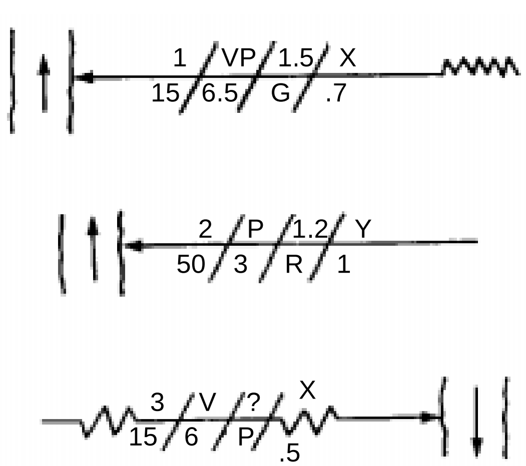
Record the composition of the approaches. They may be paved or covered with mat or trackway, but they are usually unimproved. The composition and the slope of the approaches to a ford should be carefully noted to determine the trafficability after fording vehicles saturate the surface material of the approaches. Identify the ford's left and right approaches when looking downstream.

Record the current velocity and the presence of debris to determine their effect, if any, on the ford's condition and passability. Estimate the current as—

- Swift (more than 1.5 meters per second).
- Moderate (1 to 1.5 meters per second).
- Slow (less than 1 meter per second).

The ford's stream-bottom composition largely determines its trafficability. It is important to determine whether the bottom is composed of sand, gravel, silt, clay, or rock and in what proportions. Record whether the ford's natural river bottom has been improved to increase the load-bearing capacity or to reduce the water depth. Improved fords may have gravel, macadam, or concrete surfacing; layers of sandbags; metal screening or matting; or timber (corduroy) planking. Note if there is material nearby that may be used to improve the ford. Record limited ford information (such as the following) on maps or overlays using a symbol as shown in Figure 5-24.





Ford #1 is pedestrian and vehicular with stream velocity of 1.5 meters per second and no seasonal limitations, 15 meters long, 6.5 meters wide, gravel bottom, and 0.7 meter deep and has a difficult approach on the right bank.

Ford #2 is pedestrian with stream velocity of 1.2 meters per second with seasonal limitations, 50 meters long, 3 meters wide, rock bottom, and 1 meter deep and has easy approaches.

Ford #3 is vehicular with stream velocity unknown and no seasonal limitations, 15 meters long, 6 meters wide, artificial paving, is 0.5 meter deep and has difficult approaches on both banks.

Figure 5-24. Ford symbols

- The ford's geographic location is shown by an arrow from the symbol to the ford location on a map or overlay. The symbol is drawn on either side of the stream.
- A serial number is assigned to each ford for reference (if the map sheet has a preassigned serial number, use it). Follow the unit's SOP in assigning serial numbers. They must not be duplicated within any one map sheet, overlay, or document.

- The type of ford is determined by bottom conditions, width, and water depth. Use the letters “V” for vehicular or “P” for pedestrian to show the ford type. Approaches are not considered in determining the ford type.
- The stream’s normal velocity is expressed in meters per second. Seasonal limiting factors follow the stream-velocity notation and are shown by the letters—
  - X = no seasonal limitations except for sudden flooding of limited duration (such as flash floods).
  - Y = serious, regular, or recurrent flooding or snow blockage. **NOTE: If the Y symbol is used, the route type in the route-classification formula automatically becomes type Z.**
- The length of the ford, expressed in meters, is the distance from the near to far shores. The width of the ford is the traveled-way width of the ford’s bottom.
- The nature of the bottom is indicated by the most appropriate letter symbol:
  - M = mud.
  - C = clay.
  - S = sand.
  - G = gravel.
  - R = rock.
  - P = artificial paving.
- The normal depth is the depth of water at the deepest point, expressed in meters. During a hasty recon, the actual water depth is used.
- A stream’s left and right banks are found by looking downstream. Imagine yourself in the middle of the stream and looking downstream. Your left arm would indicate the left bank and the right arm the right bank. In drawing this portion of the symbol, pay attention to the direction of the stream flow. A difficult approach is shown by irregular lines placed on the corresponding side of the basic symbol.

All elements of the ford symbol are separated by slashes. If you do not know or cannot determine any item of the ford symbol, substitute a question mark for the required information. (Record ford information on DA Form 1251. See Figures 5-25 and 5-26, pages 5-30 and 5-31.)

UNDERWATER RECON

In deeper water, divers may have to determine bottom conditions. Diving teams trained and equipped for underwater recons select deep-water fording sites. When the divers cannot easily span the distance between banks, inflatable combat rubber recon craft or bridge-erection boats enter the water at a selected entrance and drop off teams at regular intervals. Unless the area is under enemy fire or observation, the craft remain in the water during the

FORD RECONNAISSANCE REPORT

For use of this form, see FM 5-36; the proponent agency is TRADOC.

DATE: 29 Aug 84

TO: (Headquarters ordering reconnaissance) Cdr, ATTN: S-2, 21st Engr Bn

FROM: (Name, grade and unit of reconnaissance officer) Ronald Perrin
RONALD PERRIN, SFC, Co A, 21st Engr

1. ROUTE NUMBER	2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of signature)
Virginia 617	UT 122864	UT 097899	291800 Aug 84

5. MAP SERIES NUMBER	6. SHEET NUMBER	7. GRID REFERENCE: TYPE	COORDINATES	8. FORD NUMBER
V 734	5561 III	1:50,000	UT 100886	1

9. LOCATION FROM NEAREST TOWN: DISTANCE	DIRECTION	NAME OF NEAREST TOWN	10. CROSSING (Name of stream or other body of water)
14 Km	SE	Ft. Belvoir, VA	Accotink Creek

11. CHARACTERISTICS OF CROSSING

WATER LEVELS	WIDTH	DEPTH	VELOCITY	DATE	SEASON OR MONTH(S)
TODAY	7.3 m	.5 m	1.5 m/sec	29 Aug 84	
LOW	6.1 m	.3 m	1.1 m/sec	14 Jun 80	
MEAN	7.3 m	.5 m	2 m/sec		
HIGH	8.4 m	1.8 m	2.2 m/sec		

12. BOTTOM: ☐ SAND ☑ GRAVEL ☐ STONE ☐ OTHER

13. APPROACHES: ☐ FIRM ☐ SOFT ☑ PAVED

14. SLOPE RATIO: 3:1

15. TYPE OF PAVEMENT: Bituminous

16. 5.3 m

17. HAZARDS (Flash floods, quicksand, etc.): Unknown

18. REMARKS (Description of Approach Roads, Guide Markers, Depth Gages, etc.)

The bottom is loose gravel, 9.8 m long, 7.3 m wide, .5 m deep, with a velocity of 1.5 m/sec. There appear to be no seasonal limitations. Approach conditions on both banks are easy. All measurements with a 100-meter tape measure. A yard stick was used to measure depth.

DA FORM 1 JAN 58 1251

SAMPLE

Figure 5-25. Sample Ford Reconnaissance Report (front)

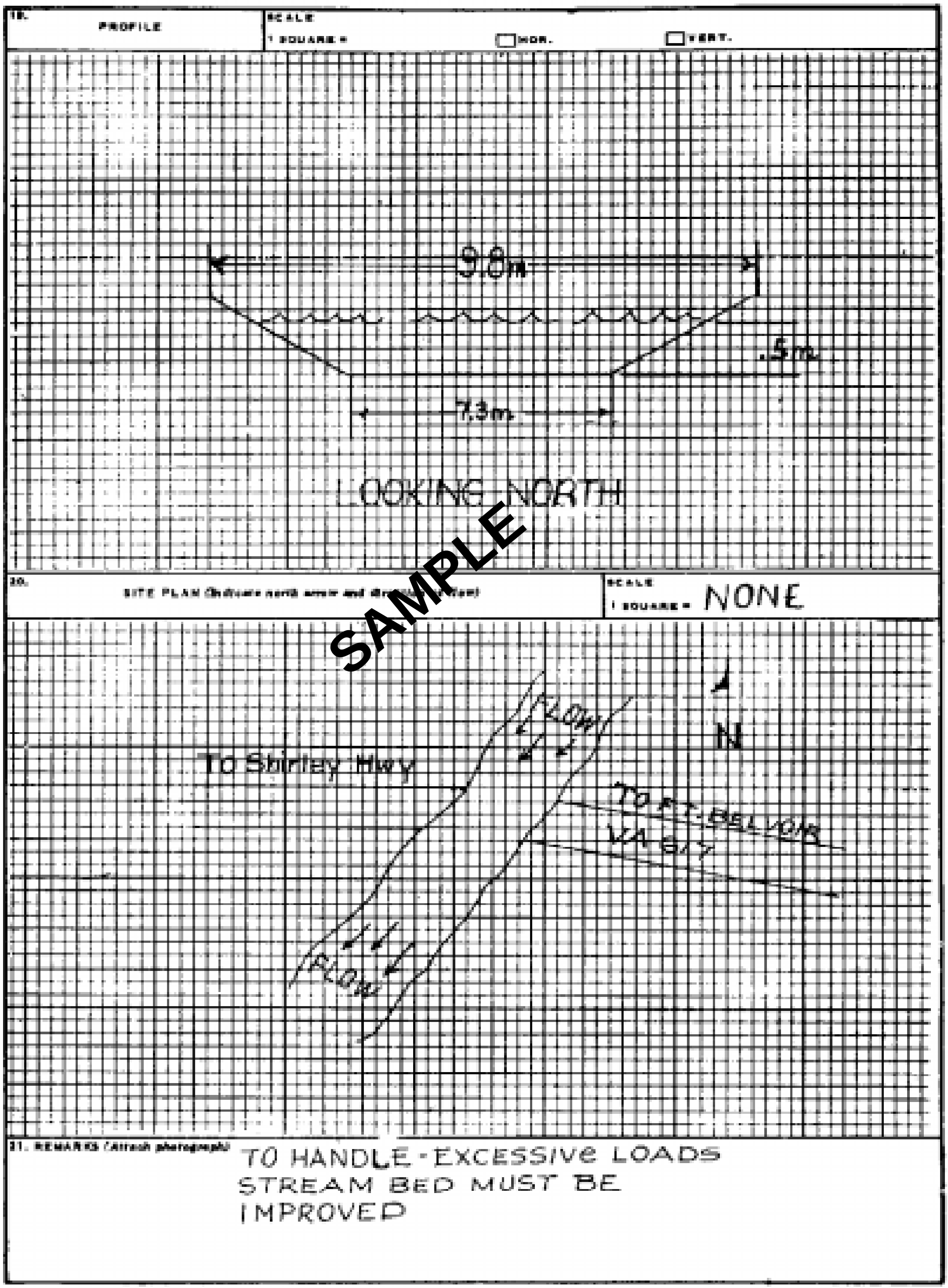


Figure 5-26. Sample Ford Reconnaissance Report (back)

recon and pick up divers when the operation is completed. Helicopters may be used to drop teams in the water or place teams on the far shore if the situation permits. Engineer light diving teams routinely conduct river recons at night.

To assist underwater recon teams in maintaining direction, weighted lines (transverse lines) may be placed across the bottom of the water obstacle. Buoys or other floating objects are attached to the lines to indicate the survey area for the underwater recon team(s). When the current is greater than 1.3 meters per second, underwater recon personnel will have difficulty maintaining a position along the line selected. To assist divers, another transverse line, parallel to the original line and with lateral lines connecting both lines, may be placed upstream.

Bottom conditions are easily determined during periods of good visibility and when the water is clear. However, under blackout conditions or when the water is murky, the recon is much slower because swimmers must feel their way across. If the tactical situation permits, diver's may use underwater lanterns.

Environmental conditions (such as depth, bottom type, tides and currents, visibility, and temperature) have an effect on divers, diving techniques, and equipment. The length of time that divers can remain underwater depends on water depth, time at depth, and equipment used. When conducting a recon in a current, swimmers expend more energy, tire more easily, and use their air supply more quickly. In water temperatures between 73° and 85°F, divers can work comfortably in their swimsuits, but will chill in one to two hours if not exercising. In water temperatures above 85°F, the divers overheat. The maximum water temperature that can be endured, even at rest, is 96°F. At temperatures below 73°F, unprotected divers will be affected by excessive heat loss and become chilled within a short period of time. In cold water, the sense of touch and the ability to work with the hands are affected. Air tanks vary in size and govern how long divers can operate. Extra tanks should be available for underwater recon teams, and the facilities to recharge equipment should be located close enough to respond to team requirements.

Units may develop a river-recon report to transmit important information about the river's location, near- and far-shore characteristics, and river characteristics. A sample report is shown in Figures 5-27 and 5-28, pages 5-33 and 5-34.

FERRY RECON

Ferries are considered obstructions to traffic flow and are indicated by the abbreviation "OB" in the route-classification formula. Ferryboat construction varies widely and ranges from expedient rafts to ocean-going vessels. Ferries differ in physical appearance and capacity depending upon the water's width, depth, and current and the characteristics of the traffic to be moved. Ferries may be propelled by oars; cable and pulleys; poles; the stream current; or steam, gasoline, or diesel engines.

CIVIL FERRIES AND FERRY SITES

Usually, the capacity of a civil ferryboat is expressed in tons and total number of passengers. In addition, it is often assigned an MLC number. Ensure that

RIVER RECONNAISSANCE REPORT			DATE: 24 NOV 97
TO: (Headquarters requesting recon) CDR, ATTN: S2, 536th ENG BN		FROM: (Name, grade and unit of recon officer) Mark A. Wilson WILSON, MARK A., SFC, A CO, 536th ENG BN	
1. ROUTE NUMBER: AP HILL 004	2. FROM: (Initial point) TT945209	3. TO: (Terminal point) TT938180	4. DATE/TIME (of signature) 290800 NOV 97
5. MAP SERIES NUMBER: V7345	6. SHEET NUMBER: 5560 III	7. GRID REFERENCE: TYPE 1:50,000; COORDINATES TT945185	8. RECON NUMBER: 1

9. LOCATION OF NEAREST TOWN			10. CROSSING (Name of river or other body of water)
DISTANCE: 2KM	DIRECTION: SW	NAME OF NEAREST TOWN: COLLINS CROSSING	CATTLET CREEK

11. CHARACTERISTICS OF NEAR SHORE

BANK HEIGHT	BANK SLOPE	BANK STABILITY	BANK SOIL TYPE	MINES	OBSTACLES (Type)
1.8 METERS	6%	FIRM	GRASS	NONE	NONE

SLOPE TO DEPTH OF 2 METERS	SOIL TYPE TO 2 METERS OF DEPTH	MINES TO DEPTH OF 2 METERS	OBSTACLES TO DEPTH OF 2 METERS
10%	SOFT MUD	NONE	NONE

SAMPLE

12. CHARACTERISTICS OF RIVER

GAP WIDTH	VELOCITY (m/sec)	FLOW DIRECTION	BOTTOM COMPOSITION (Mud, sand, gravel/hard packed or soft)
143 METERS	1.5 MPS	SW	¼ GAP SOFT MUD; ½ GAP SOFT MUD; ¾ GAP SOFT MUD

MAX DEPTH	ANCHORAGE SUITABILITY (Describe)	OBSTACLES
¼ GAP 12'; ½ GAP 18'; ¾ GAP 10'	VERY GOOD / RECOMMEND USING KEDGE ANCHORS	NONE

13. CHARACTERISTICS OF FAR SHORE

BANK HEIGHT	BANK SLOPE	BANK STABILITY	BANK SOIL TYPE	MINES	OBSTACLES
.8 METERS	9%	FIRM	GRASS	NONE	NONE

SLOPE TO DEPTH OF 2 METERS	SOIL TYPE TO DEPTH OF 2 METERS	MINES TO DEPTH OF 2 METERS	OBSTACLES TO DEPTH OF 2 METERS
9%	SOFT MUD	NONE	STUMP LOCATED AT 3'

REMARKS: (Description of far- and near-shore approaches/assembly areas/ available cover and concealment/ overall assessment of crossing-site potential, potential for freezing over or flooding)

- NEAR-SHORE APPROACH IS APPROX 150 METERS WIDE WITH FIRM SOIL AND GRASS BUT NO OVERHEAD COVER.
- FAR-SHORE APPROACH IS APPROX 80 METERS WIDE WITH FIRM SOIL AND GRASS. NOTE: STUMP LOCATED AT 3' MEASURING 26 INCHES IN DIAMETER. STUMP NEEDS TO BE REMOVED BEFORE FAR SHORE CAN BE UTILIZED.
- CROSSING SITE HAS NO HISTORY OF FLOODING, BUT HAS POTENTIAL FOR FREEZING OVER IN LATE JANUARY THRU MARCH.

Figure 5-27. Sample River Reconnaissance Report (front)

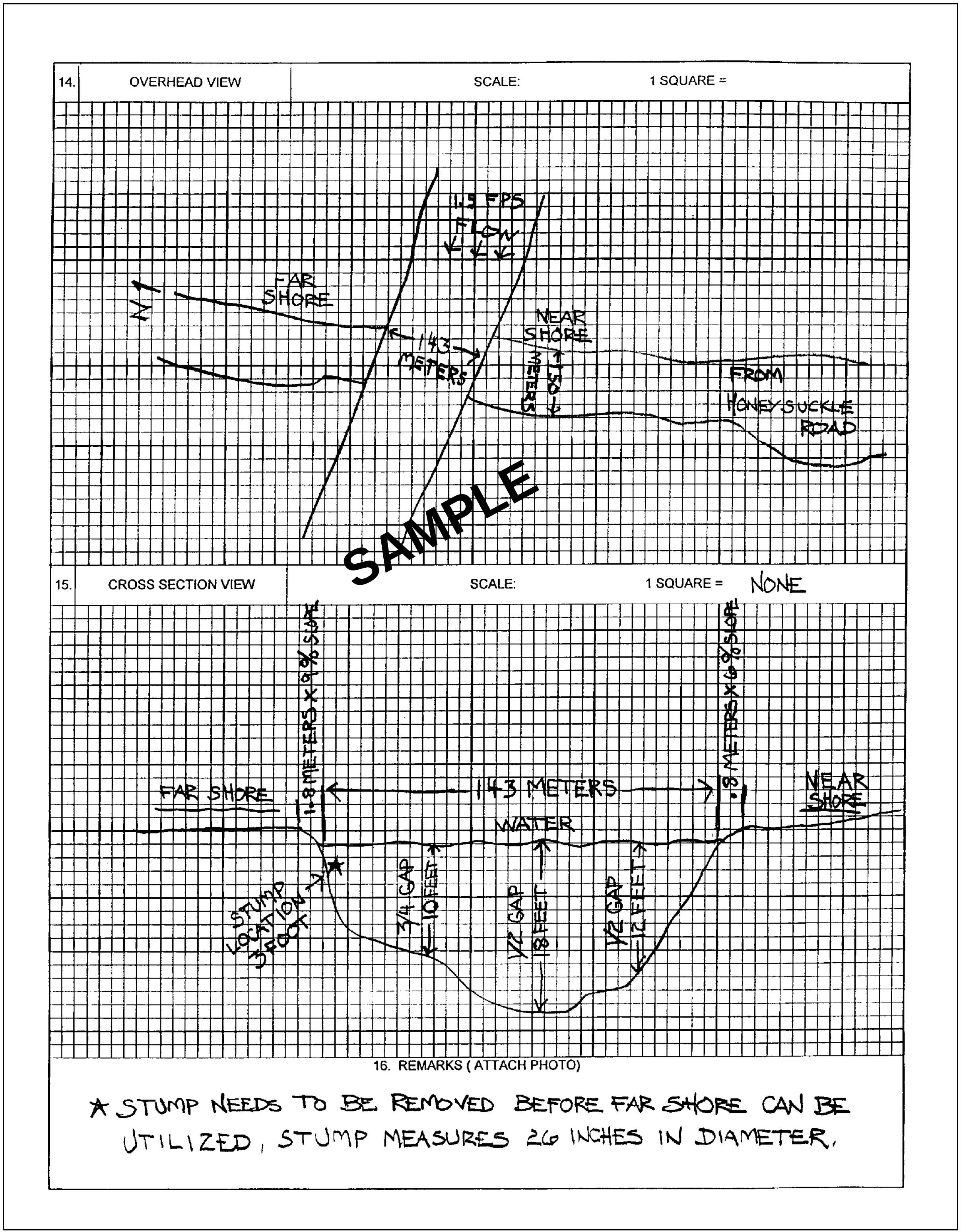


Figure 5-28. Sample River Reconnaissance Report (back)

you record the capacity of each ferry when more than one is used at a given site. The ferries may vary in capacity.

Ferry slips (or piers) are usually provided on each shore to permit easy loading of passengers, cargo, and vehicles. The slips may range from simple log piers to elaborate terminal buildings. A distinguishing characteristic of a ferry slip is often the floating pier that adjusts, with changes in the water depth, to the height of the ferryboat.

Approach routes to ferry installations have an important bearing on using the ferry. Reconning and recording the conditions of the approaches (including the load-carrying capacity of landing facilities) is very important.

Limiting characteristics of ferry sites that should be considered are the—

- Width of the water barrier from bank to bank.
- Distance and time required for the ferryboat to travel from one bank to the other.
- Depth of the water at each ferry slip.
- Ease in which each landing site can be defended.

Climatic conditions affect ferry operations. Fog and ice substantially reduce the total traffic-moving capacity and increase the hazard of the water route. Therefore, you must consider data on tide fluctuations, freezing periods, floods, excessive dry spells, and their effects on ferry operations.

FERRY INFORMATION

Record limited ferry information (such as the following) on maps or overlays by using the symbol shown in Figure 5-29. Figure 5-30, page 5-36, gives examples of completed ferry symbols.

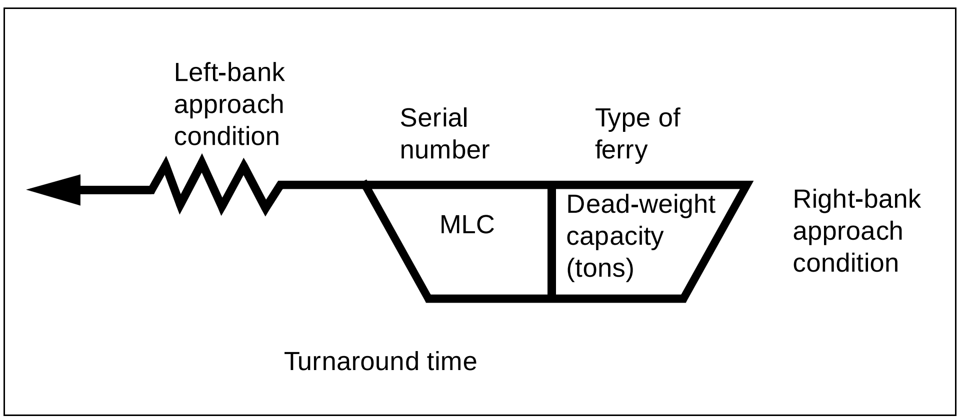


Figure 5-29. Ferry symbol

- The geographic location of the ferry is shown by an arrow from the symbol to the location of the ferry on a map or overlay. The symbol may be drawn on the map or overlay on either side of the stream.
- A serial number is assigned to each ferry, for later reference. Numbers must not be duplicated within any one map sheet, overlay, or

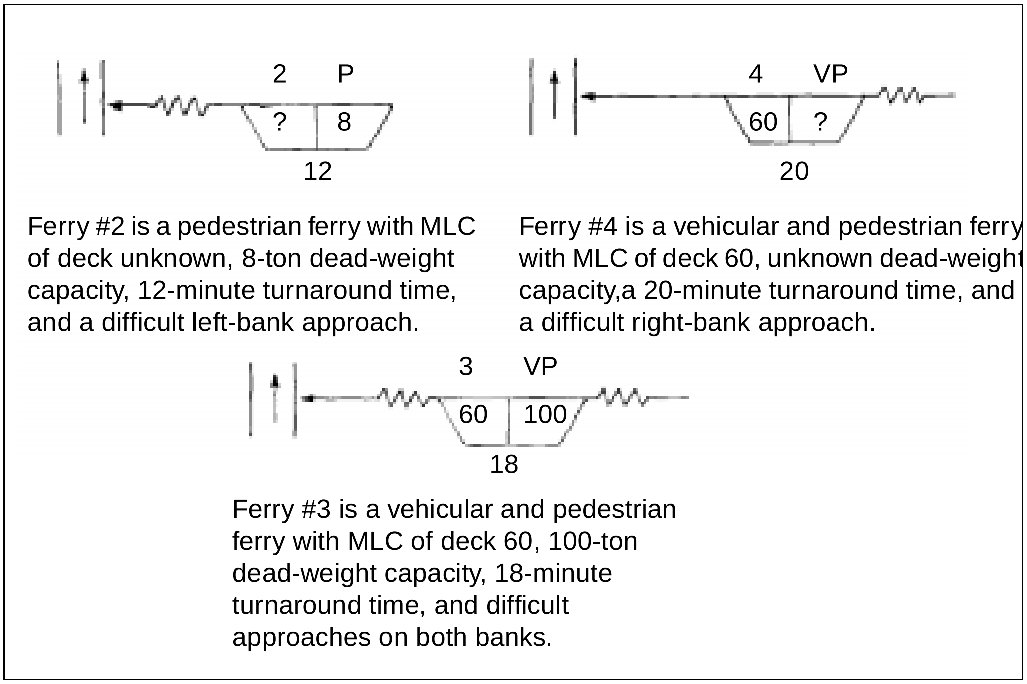


Figure 5-30. Sample ferry symbols

document. Some maps will already show a ferry serial number. Use this number for your recon. If you do not find a number, record a number according to the unit's SOP.

- The type of ferry (V for vehicular and P for pedestrian) is shown after the serial number. If the ferry can haul vehicles, it can also haul pedestrians.
- The deck's MLC is placed in the bottom left box of the symbol. Most ferries have this information on their data plate.
- The dead-weight capacity of the ferry is the MLC plus the actual weight of the ferry, in short tons.
- The turnaround time is shown by the number of minutes required to cross the water obstacle, unload, and return.

When drawing the approach-condition portion of the symbol, pay attention to the direction of stream flow. Left and right banks are determined by looking downstream. Approach conditions are determined in the same manner as for fords. A difficult approach is shown by irregular lines placed on the corresponding side of the basic symbol.

A question mark is substituted for unknown or undetermined information. Detailed ferry recon information is recorded on DA Form 1252 (see Figures 5-31 and 5-32, pages 5-37 and 5-38).

MILITARY FERRY AND RAFTING

Recon personnel will be required to locate and report suitable sites for military rafting or ferrying operations. Military floating bridges are presently available for such operations. Desirable site characteristics are—

FERRY RECONNAISSANCE REPORT
For use of this form, see FM 5-36; the proponent agency is TRADOC.

DATE: 18 Aug 84

TO: (Headquarters ordering reconnaissance) Cdr, ATTN: S-2, 21st Engr Bn

FROM: (Name, grade and unit of reconnaissance officer) H. L. Dugan — H L DUGAN, SFC, CoA, 21st Engr Bn

1. ROUTE OR LINE — HIGHWAY	RAILROAD	2. FROM (Initial Point)	3. TO (Terminal Point)	4. DATE/TIME (Of Signature)
VA 617	NA	Lorton, VA	Hoby, MD	181900 Aug 84

5. MAP SERIES NR	6. SHEET NUMBER	7. GRID REFERENCE — TYPE	COORDINATES	8. FERRY NR	9. CLASS
V 734	5661 III	1:50,000	UT 134830	1	45

10. LOCATION FROM NEAREST TOWN — DISTANCE	DIRECTION	NAME OF NEAREST TOWN	11. CROSSING (Name of stream or body of water)
8 Km	East	Lorton, VA	Potomac River

12. LIMITING FEATURE (Condition of vessels, terminals, floods, low water, freezing, tides etc.) (Seasons and Dates)
River freezes in winter months

13. WATER LEVELS (Depths) — LOW	MEAN	HIGH	14. CROSSING TIME	15. LENGTH
3.2 m	4.7 m	7.6 m	20 minutes	1 Km

16. VESSEL FEATURES (Attach photographs)

UNITS	CONSTRUCTION TYPE	PROPULSION METHOD — TYPE	UNITS	HP	LENGTH	BEAM	DRAFT	TONNAGE — GROSS	NET	CAPACITY — PASS	VEHICLE	R.R. CARS
2	Open	Diesel	2	610	22.5m	1.6m	1.6 m	85	85	200	8 Maximum	NA

SAMPLE

17. TERMINAL FEATURES

DIRECTION OF BANK	NAME	SLIP — WIDTH	DEPTH	CAPACITY	DOCKING FACILITIES	APPROACHES — HIGHWAY — SURF	LANES	CLASS	RAILROAD — TRACKS	SIDING
N E (S W) N	Little Reno	13.2m	3m	1	Good	Asphalt	2	45	NA	NA
(N E) S W N	Angels Point	14m	4m	1	Good	Concrete	2	55	NA	NA

18. REMARKS (Amplify above details. Note obstructions, navigational and other pertinent data)

Anchorage shown on back uses 30.5 cm piles, spaced approximately 10 meters, center to center

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Figure 5-31. Sample Ferry Reconnaissance Report (front)

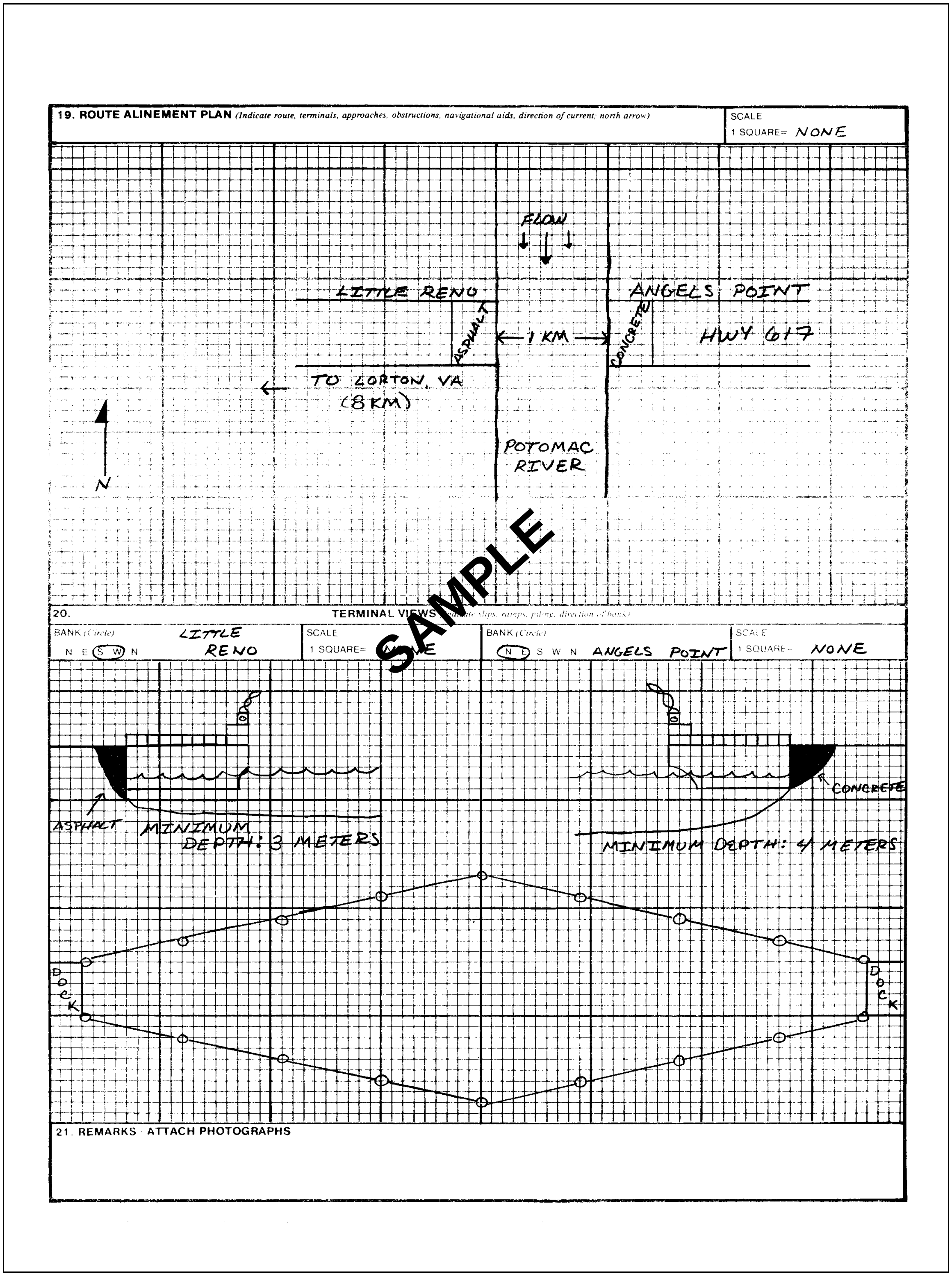

Figure 5-32. Sample Ferry Reconnaissance Report (back)

- Current velocity between 0 and 1.6 meters per second.
- Banks that permit loading without a great deal of preparation.
- Approaches that permit easy access and egress.
- Strong, natural holdfasts.
- Sites with no shoals, sandbars, or snags.
- Sites clear of obstacles immediately downstream.
- Sites clear of mines and booby traps.
- Sites with enough depth to prevent grounding the raft or ferry during loading and unloading operations or when crossing.
- Suitable raft-construction sites (dependent on type of raft).
- Holding areas for vehicles awaiting passage.
- A suitable road network to support crossing traffic.

NOTE: Refer to FM 90-13 for rafting operations.

ROAD RECON PROCEDURE

Perform a technical road recon to determine the traffic capabilities of a road within a route. In general, a road consists of a road surface, base course, and subgrade (see Figure 5-33).

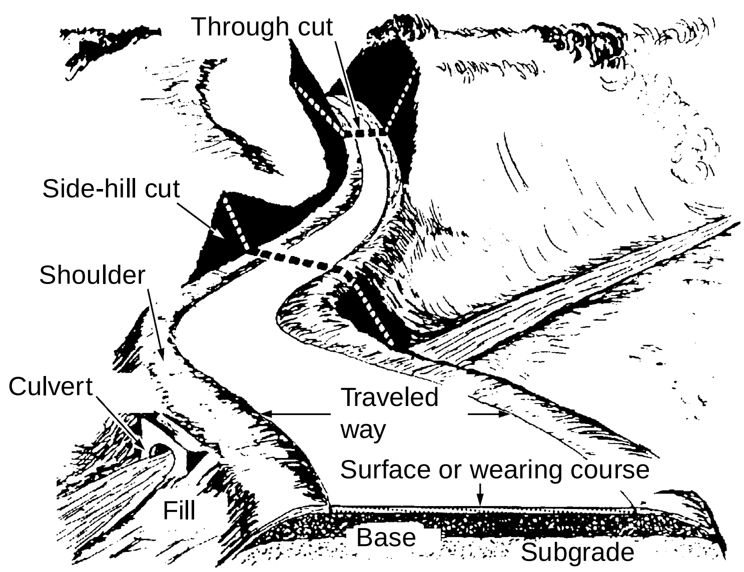

Figure 5-33. Parts of a road

BASE COURSE AND SUBGRADE

The base course and subgrade are the intermediate fill. They are usually composed of gravel or crushed rock. Soils may form the subgrade. See Tables 5-3 and 5-4, pages 5-40 through 5-42.

Table 5-3. Soil characteristics of roads and airfields

Major Divisions		Letter		Name	Field CBR
Coarse-grained soils	Gravel and gravelly soils	GW		Well-graded gravels or gravel-sand mixtures, little or no fines	60-80
		GP		Poorly graded gravels or gravel-sand mixtures, little or no fines	25-60
		GM	d[1]	Silty gravels, gravel-sand-silt mixtures	40-80
			u[2]		20-40
		GC		Clayey gravels, gravel-sand-clay mixtures	20-40
	Sand and sandy soils	SW		Well-graded sands or gravelly sands, little or no fines	20-40
		SP		Poorly graded sands or gravelly sands, little or no fines	10-25
		SM	d[1]	Silty sands, sand-silt mixtures	20-40
			u[2]		10-20
		SC		Clayey sands, sand-clay mixtures	10-20
Fine-grained soils	Silts and clays (liquid limits <50)	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	5-15
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	5-15
		OL		Organic silts and organic silt-clays of low plasticity	4-8
	Silts and clays (liquid limits >50)	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	4-8
		CH		Inorganic clays of high plasticity, fat clays	3-5
		OH		Organic clays of medium to high plasticity, organic silts	3-5
Highly organic soils		Pt		Peat and other highly organic soils	

[1]Indicates liquid limit is 28 or less, and plasticity index is 6 or less.
[2]Indicates liquid limit is 28 or greater.

Table 5-3. Soil characteristics of roads and airfields (continued)

Letter		Value as Foundation When Not Subject to Frost Action[3]	Value as Base Directly Under Bituminous Pavement	Potential Frost Action[4]	Compressibility and Expansion	Drainage Characteristics
GW		Excellent	Good	None to very slight	Almost none	Excellent
GP		Good to excellent	Poor to fair	None to very slight	Almost none	Excellent
GM	d[1]	Good to excellent	Fair to good	Slight to medium	Very slight	Fair to poor
	u[2]	Good	Poor	Slight to medium	Slight	Poor to practically impervious
GC		Good	Poor	Slight to medium	Slight	Poor to practically impervious
SW		Good	Poor	None to very slight	Almost none	Excellent
SP		Fair to good	Poor to not suitable	None to very slight	Almost none	Excellent
SM	d[1]	Good	Poor	Slight to high	Very slight	Fair to poor
	u[2]	Fair to good	Not suitable	Slight to high	Slight to medium	Poor to practically impervious
SC		Fair to good	Not suitable	Slight to high	Slight to medium	Poor to practically impervious
ML		Fair to poor	Not suitable	Medium to very high	Slight to medium	Fair to poor
CL		Fair to poor	Not suitable	Medium to high	Medium	Practically impervious
OL		Poor	Not suitable	Medium to high	Medium to high	Poor
MH		Poor	Not suitable	Medium to high	High	Fair to poor
CH		Poor to very poor	Not suitable	Medium	High	Practically impervious
OH		Poor to very poor	Not suitable	Medium	High	Practically impervious
Pt		Not suitable	Not suitable	Slight	Very high	Fair to poor

[3]Values are for subgrades and base courses except for base courses under bituminous pavement.
[4]Indicates whether these soils are susceptible to frost.

Table 5-4. Principal soil types

Name	Description
Gravel	A mass of detached rock particles, generally waterworn, which passes a 3-inch sieve and is retained on a No. 4 sieve (0.187 inches).
Sand	Granular material composed of rock particles which pass a No. 4 sieve (0.187 inches) and are retained on a No. 200 sieve (0.0029 inches). It is difficult to distinguish sand from silt when the particles are uniformly small. Dried sand, however, differs from silt in that it has no cohesion and feels grittier.
Silt	A fine, granular material composed of particles which pass the No. 200 sieve (0.0029 inches). It lacks plasticity and has little dry strength. To identify, prepare a pat of wet soil and shake it horizontally in the palm of the hand. With typical inorganic silt, the shaking action causes water to come to the surface of the sample, making it appear glossy and soft. Repeat tests with varying moisture contents. Squeezing the sample between the fingers causes the water to disappear from the surface and the sample quickly stiffens and finally cracks or crumbles. Allow sample to dry, test its cohesion, and feel by crumbling with the fingers. Typical silt shows little or no dry strength and feels only slightly gritty in contrast to the rough grittiness of fine sand.
Clay	Extremely fine-grained material composed of particles which pass the No. 200 sieve (0.0029 inches). To identify, work a sample with the fingers, adding water when stiffness requires. Moist sample is plastic enough to be kneaded like dough. Test further by rolling ball of kneaded soil between palm of hand and a flat surface. Clay can be rolled to a slender thread, about 1/4 inch in diameter, without crumbling; silt crumbles, without forming a thread. Measure hardness of dry clay by finger pressure required to break a sample. It requires much greater force to break dry clay than dry silt. Clay feels smooth in contrast to the slight grittiness of silt.
Organic	Soil composed of decayed or decaying vegetation, sometimes mixed with fine-grained mineral sediments such as peat or muskeg. It is identified by coarse and fibrous appearance and odor. Odor may be intensified by heating. Plastic soils containing organic material can be rolled into soft, spongy threads.

ROAD-CAPACITY COMPUTATIONS

The charts that follow will help give you an accurate estimation of the load-bearing capacity of a road with flexible pavement. Tables 5-3 (pages 5-40 and 5-41), 5-4 (page 5-42), and 5-5 and Figure 5-34 (page 5-44) will help determine the road's load-bearing capacity. The load-bearing capacity of a road for wheeled vehicles is made by measuring the thickness of the surface and base course and by determining the type of subgrade material.

Table 5-5. Maximum axle and wheel loads for wheeled vehicles

Hypothetical Vehicle Class Number	Maximum Single-Axle Load (in tons)	Maximum Single-Wheel Load (in pounds x 1,000)
4	2.5	2.5
8	5.5	5.5
12	8.0	8.0
16	10.0	10.0
20	11.0	11.0
24	12.0	12.0
30	13.5	13.5
40	17.0	17.0
50	20.0	20.0
60	23.0	20.0
70	25.5	20.0
80	28.0	20.0
90	30.0	20.0
100	32.0	20.0
120	36.0	20.0
150	42.0	21.0

ROAD-CLASSIFICATION FORMULA

The road-classification formula is a systematic way of describing the worst section of a road. Do not confuse it with the route-classification formula. Recorded information from the road-classification formula is included in the route-classification formula. The following paragraphs describe each portion of the formula shown below:

B g s 4 / 5 r (8 km) (OB) (T)
(1) (2) (3) (4) (5) (6)

(1) Limiting characteristics. Prefix the formula with "A" if there are no limiting characteristics and "B" if there are one or more limiting characteristics. Represent an unknown or undetermined characteristic by a question mark, together with the feature to which it refers. In the example above, the letter *g* indicates steep gradients and the letter *s* indicates a rough surface (see Table 5-6, page 5-44).

(2) Minimum traveled-way width. Express this width in meters followed by a slash and the combined width of the traveled way and the shoulders. In the example above, the minimum traveled way is 4 meters and the combined width is 5 meters.

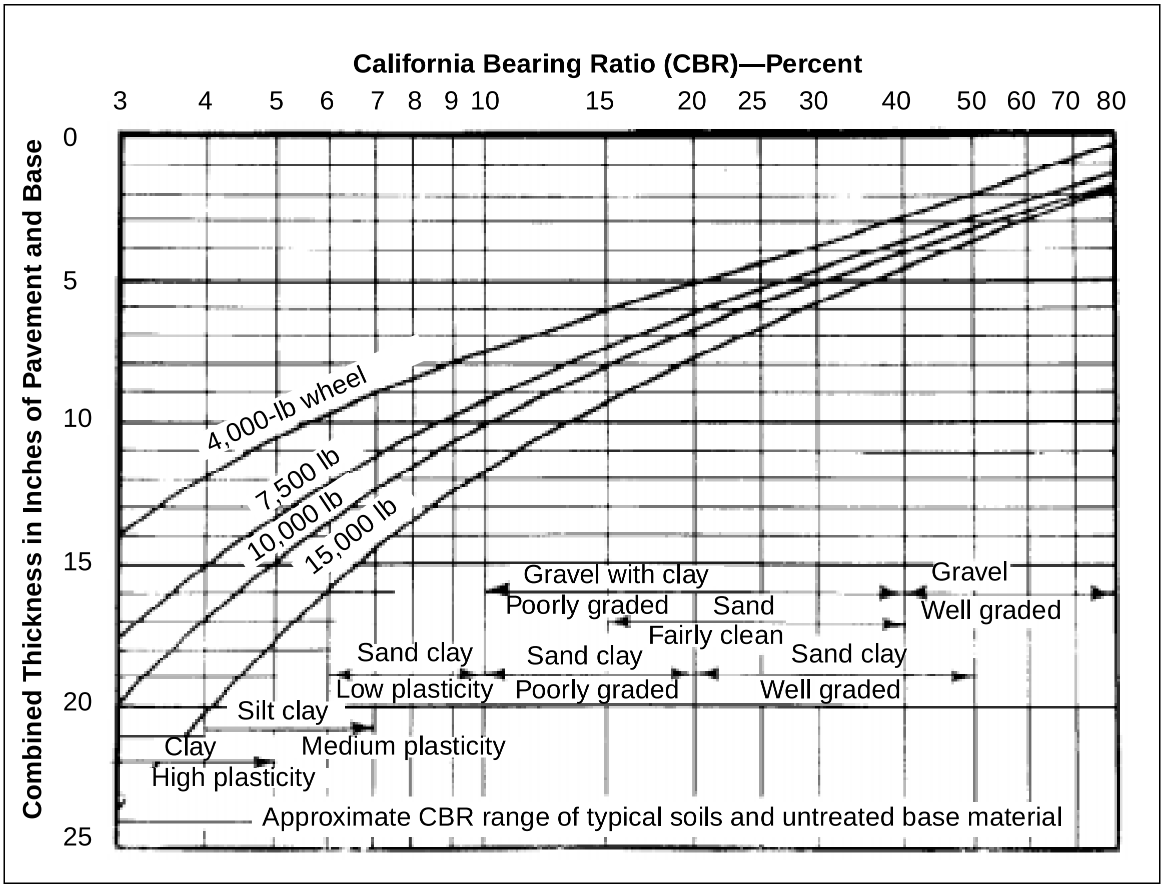

Figure 5-34. Load-bearing capacity of roads with a flexible surface

Table 5-6. Symbols for limiting characteristics

Limiting Characteristics	Criteria	Symbol
Sharp curves	Sharp curves with radius of 25 meters and less (82 ft); are also reported as obstructions	c
Steep gradients	Steep gradients, 7 percent or steeper; such gradients are also reported as obstructions	g
Poor drainage	Inadequate ditches, crown or camber, or culverts; culverts and ditches blocked or otherwise in poor condition	d
Weak foundation	Unstable, loose, or easily displaced material	f
Rough surface	Bumpy, rutted, or potholed to an extent likely to reduce convoy speeds	s
Excessive camber or superelevation	Falling away so sharply as to cause heavy vehicles to skid or drag toward shoulders	j

(3) Road-surface material. Express this with a letter symbol. The formula above describes the surface material as *r*, meaning water-bound macadam. Use the symbols listed in Table 5-7; they are further related to the X, Y, and Z route types of the route classification described earlier in route-recon procedures.

Table 5-7. Symbols for type of surface materials

Symbol	Material	Route Type
k	Concrete	Type X; generally heavy duty
kb	Bituminous (asphaltic) concrete (bituminous plant mix)	Type X; generally heavy duty
p	Paving brick or stone	Type X or Y; generally heavy duty
pb	Bituminous surface on paving brick or stone	Type X or Y; generally heavy duty
rb	Bitumen-penetrated macadam, water-bound macadam with superficial asphalt or tar cover	Type X or Y; generally medium duty
r	Water-bound macadam, crushed rock or coral or stabilized gravel	Type Y; generally light duty
l	Gravel or lightly metaled surface	Type Y; generally light duty
nb	Bituminous surface treatment on natural earth, stabilized soil, sand-clay, or other select material	Type Y or Z; generally light duty
b	Used when type of bituminous construction cannot be determined	Type Y or Z; generally light duty
n	Natural earth stabilized soil, sand-clay, shell, cinders, disintegrated granite, or other select material	Type Z; generally light duty
v	Various other types not mentioned above	Classify X, Y, or Z depending on the type of material used (indicate length when this symbol is used).

(4) Road length. Express the road length in kilometers and place in parentheses.

(5) Obstructions. Indicate any obstructions along a road by placing the symbol "OB" after the road length, as shown in the example above. Details of the obstructions are not shown in the formula; they are reported separately by appropriate symbols on accompanying maps or overlays or on DA Form 1248. Report the following obstructions:

- Overhead obstructions (less than 4.3 meters over the route).
- Constrictions in traveled-way widths less than 6 meters for single-flow traffic or less than 8 meters for double-flow traffic (tracked or combination vehicles [see Table 5-1, page 5-5]).
- Slopes of 7 percent or greater.
- Curves with a radius of less than 25 meters (report curves of 25.1 to 45 meters).

(6) Blockage. If blockage is regular, recurrent, and serious, then the effects of snow blockage and flooding are indicated in the road-classification

formula. The symbol for snow blockage is “T” and the symbol for frequent flooding is “W.”

EXAMPLES OF THE ROAD-CLASSIFICATION FORMULA

A sample Road Reconnaissance Report is shown in Figures 5-35 and 5-36, pages 5-47 and 5-48. The following are examples of the road-classification formula:

- **A 5.0/6.2k**—road with no limiting characteristics or obstructions, a minimum traveled way of 5.0 meters, a combined width of traveled way and shoulders of 6.2 meters, and a concrete surface.
- **B g s 4/5 1 (OB)**—road with limiting characteristics of steep gradients and a rough surface, a minimum traveled way of 4 meters, a combined width of 5 meters, gravel or lightly metaled surfaces, and obstructions.
- **B c (f?) 3.2/4.8 p (4.3km) (OB) (T)—**road with limiting characteristics of sharp curves and unknown foundation, a minimum traveled way of 3.2 meters, a combined width of 4.8 meters, paving brick or stone surface, obstructions and that is 4.3 kilometers longsubject to snow blockage.

NOTES:

1. Where rock slides are a hazard or poor drainage is a problem, include information on a written enclosure or legend.

2. DA Form 1248 is primarily self-explanatory. However, ensure that a new classification formula is entered each time the road changes significantly, as depicted in Figure 5-36.

BRIDGE-CLASSIFICATION RECON

A bridge recon must take place to ensure that commanders know what bridge load-carrying capabilities are along a certain route or what material is needed to destroy a bridge. Engineers are responsible for reconning all bridges.

REQUIRED BRIDGE INFORMATION FOR CLASSIFICATION PROCEDURES

This manual reviews the basics of hasty bridge load-classification procedures and recon procedures for bridge destruction. Appendix B references hasty bridge classification. (Refer to FM 5-446 for a complete discussion of bridge-classification procedures.) The Sheffield Method for bridge destruction is discussed in FM 5-250.

The method of bridge load classification covered in Appendix B is adequate for most bridge recons. It allows vehicle operators to avoid bridge failure by determining what can cross the bridge without causing damage. Vehicle operators may cross without restrictions if their vehicle’s load class (including the load) is less than or equal to the bridge’s load class. The vehicle’s load class can be found in the vehicle’s TM.

ROAD RECONNAISSANCE REPORT

For use of this form, see FM 5-36; the proponent agency is TRADOC.

DATE: 29 Aug 84

TO: (Headquarters ordering reconnaissance)
Cdr, ATTN: S-2, 21st Engr Bn

FROM: (Name, grade and unit of officer or NCO making reconnaissance)
D. Mooneyhan
D. MOONEYHAN, SFC, C Co, 21st Engr Bn

1. MAPS: a. COUNTRY: Ft. Belvoir Special | b. SCALE: 1:50,000 | c. SHEET NUMBER OF MAPS: AMS V733 Sheet 5561 IV | 2. DATE/TIME GROUP (Of signature): 291430 Aug 84

SECTION I - GENERAL ROAD INFORMATION

3. ROAD GRID REFERENCE: FROM: UT 122864 | TO: UT 097999

4. ROAD MARKING (Civilian or military number of road): Virginia Route 617

5. LENGTH OF ROAD (Miles or kilometers, specify): 16 km

6. WIDTH OF ROADWAY (Feet or meters, specify): 6.7 m to 9.3 m

8. WEATHER DURING RECONNAISSANCE (Include last rainfall, if known): Fair - Temp 79° Last Rainfall - 15 Aug 84

7. RECONNAISSANCE: DATE: 29 Aug 84 | TIME: 0615

SECTION II - DETAILED ROAD INFORMATION (When circumstances permit more detailed information will be shown in an overlay or on the mileage chart on the reverse side of this form. Standard symbols will be used.)

9. ALINEMENT (Check one ONLY)
- (1) FLAT GRADIENTS AND EASY CURVES
- (2) STEEP GRADIENTS (Excess of 7 in 100)
- (3) SHARP CURVES (Radius less than 100 ft (30m))
- ✓ (4) STEEP GRADIENTS AND SHARP CURVES

10. DRAINAGE (Check one ONLY)
- (1) ADEQUATE DITCHES, CROWN/CAMBER WITH ADEQUATE CULVERTS IN GOOD CONDITION
- (2) INADEQUATE DITCHES, CROWN/CAMBER OR CULVERTS; ITS CULVERTS OR DITCHES ARE BLOCKED OR OTHERWISE IN POOR CONDITION

11. FOUNDATION (Check one ONLY)
- ✓ (1) STABILIZED COMPACT MATERIAL OF GOOD QUALITY
- (2) UNSTABLE, LOOSE OR EASILY DISPLACED MATERIAL

12. SURFACE DESCRIPTION (Complete items 12a and b)

a. SURFACE IS (Check one ONLY)
- ✓ (1) FREE OF POTHOLES, BUMPS, OR RUTS LIKELY TO REDUCE CONVOY SPEED
- (2) BUMPY, RUTTED OR POTHOLED TO AN EXTENT LIKELY TO REDUCE CONVOY SPEED

b. TYPE OF SURFACE (Check one ONLY)
- (1) CONCRETE
- ✓ (2) BITUMINOUS (Specify type where known): Asphalt
- (3) BRICK (Pave)
- (4) STONE (Pave)
- (5) CRUSHED ROCK OR CORAL
- (6) WATERBOUND MACADAM
- (7) GRAVEL
- (8) LIGHTLY METALLED
- (9) NATURAL OR STABILIZED SOIL, SAND CLAY, SHELL, CINDERS, DISINTEGRATED GRANITE, OR OTHER SELECTED MATERIAL
- (10) OTHER (Describe):

SECTION III - OBSTRUCTIONS (List in the columns below particulars of the following obstructions which affect the traffic capacity of a road. If information of any factor cannot be ascertained, insert "NOT KNOWN")
(a) Overhead obstructions, less than 14 feet or 4.25 meters, such as tunnels, bridges, overhead wires and overhanging buildings.
(b) Reductions in road widths which limit the traffic capacity, such as defiles, narrow bridges, archways, and buildings.
(c) Excessive gradients (Above 7 in 100)
(d) Curves (less than 100 feet (30 meters) in radius)
(e) Fords

SERIAL NUMBER a	PARTICULARS b	GRID REFERENCE c	REMARKS d
	Steep Grade - 8%	UT 119872	200 m Long
	Sharp Curve	UT 112877	Radius 21 m
	Constriction	UT 112878	6.7 m wide, 300 m long
	Constriction	UT 105896	7 m wide, 100 m long

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SAMPLE

Figure 5-35. Sample Road Reconnaissance Report (front)

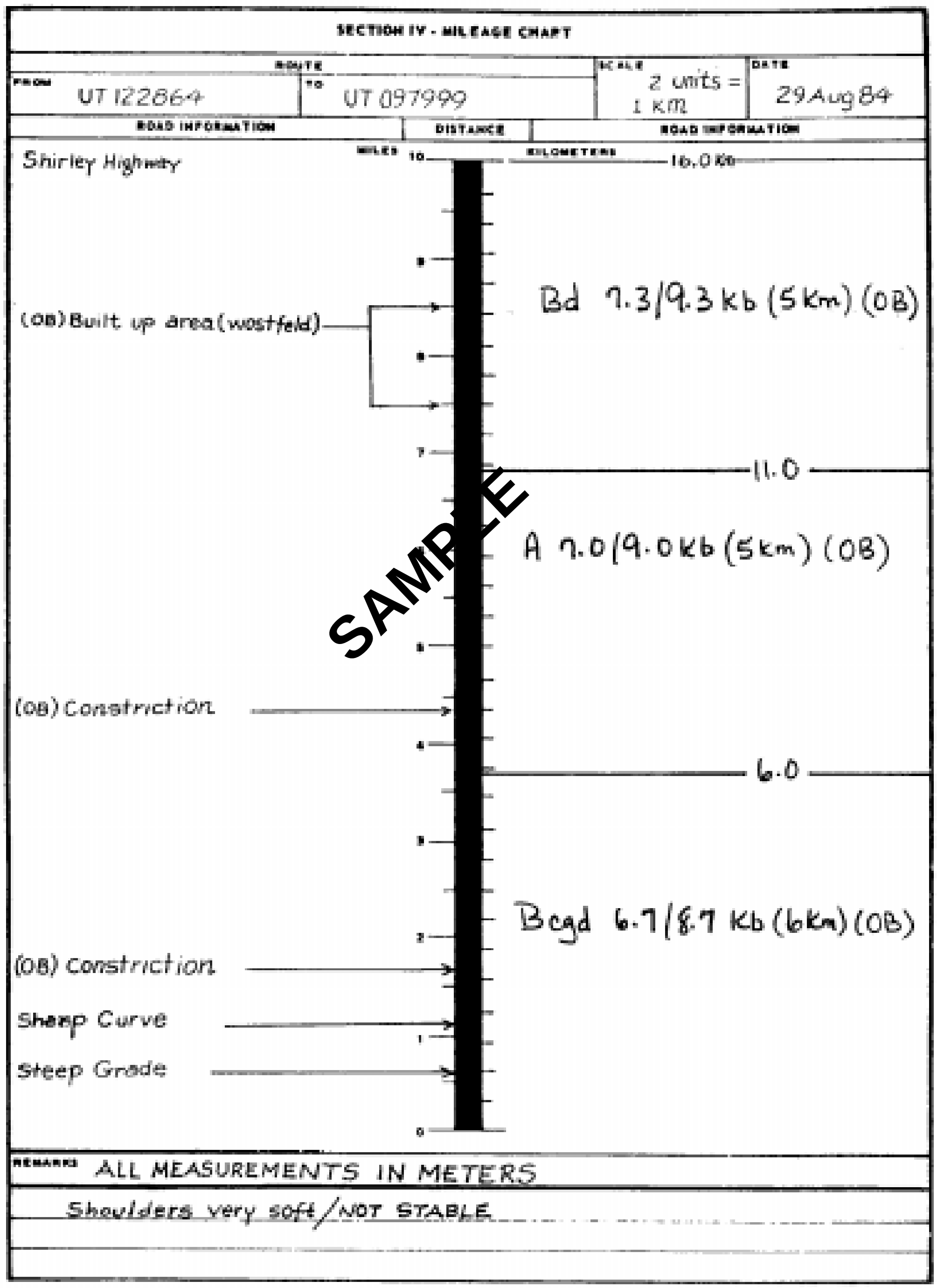


Figure 5-36. Sample Road Reconnaissance Report (back)

Appendix B covers the most common bridges in existence today, including a—

- Timber or steel trestle bridge with timber deck.
- Steel-stringer bridge with concrete deck.
- Concrete steel-stringer bridge.
- Concrete T-beam bridge with asphalt surface.
- Masonry arch bridge.

REQUIRED INFORMATION

To classify a bridge (see Appendix B), you must know the information concerning the bridge's basic components, including the following:

- **Approaches (the portions of a route leading to a bridge).** Approaches may be mined or booby trapped, requiring thorough investigation during a recon.
- **Substructure (lower part of a bridge).** The substructure consists of the abutments and intermediate supports that transfer the bridge's load to the ground. It is important to measure all aspects of an abutment, including its height, width, and length; the abutment wings; and the intermediate supports for bridge demolition missions. It may be more feasible to destroy the intermediate supports or abutments when compared to the rest of the bridge structure.
- **Superstructure (the upper part of a bridge).** The superstructure consists of the following components (see Figure 5-37, page 5-50):
  - — Stringers rest on and span the distance between the intermediate supports or abutments. Stringers are the superstructure's main load-carrying members. They receive the load from the flooring and the vehicles and transfer it to the substructure.
  - — The flooring system often consists of both decking and tread. The decking is laid directly over the stringers at right angles to the centerline of the bridge. The tread is laid parallel to the centerline of the bridge and between the curbs.
  - — Curbs are placed at both edges of the flooring to guide the vehicles. A vehicle with an axle that is wider than the traveled-way width (between the curbs) cannot cross the bridge. Most bridges, however, allow for vehicular overhang beyond the normal traveled area. This allowance is called horizontal clearance above the curbs and is a safety factor. Commanders must perform a risk analysis before attempting such a crossing.
  - — Railings along the bridge are built to guide drivers and to protect vehicular and foot traffic.
  - — Trusses are used in some bridge superstructures, either above or below the traveled way, to increase the load-carrying capacity. A truss is a structural element made of several members joined together to form a series of triangles.

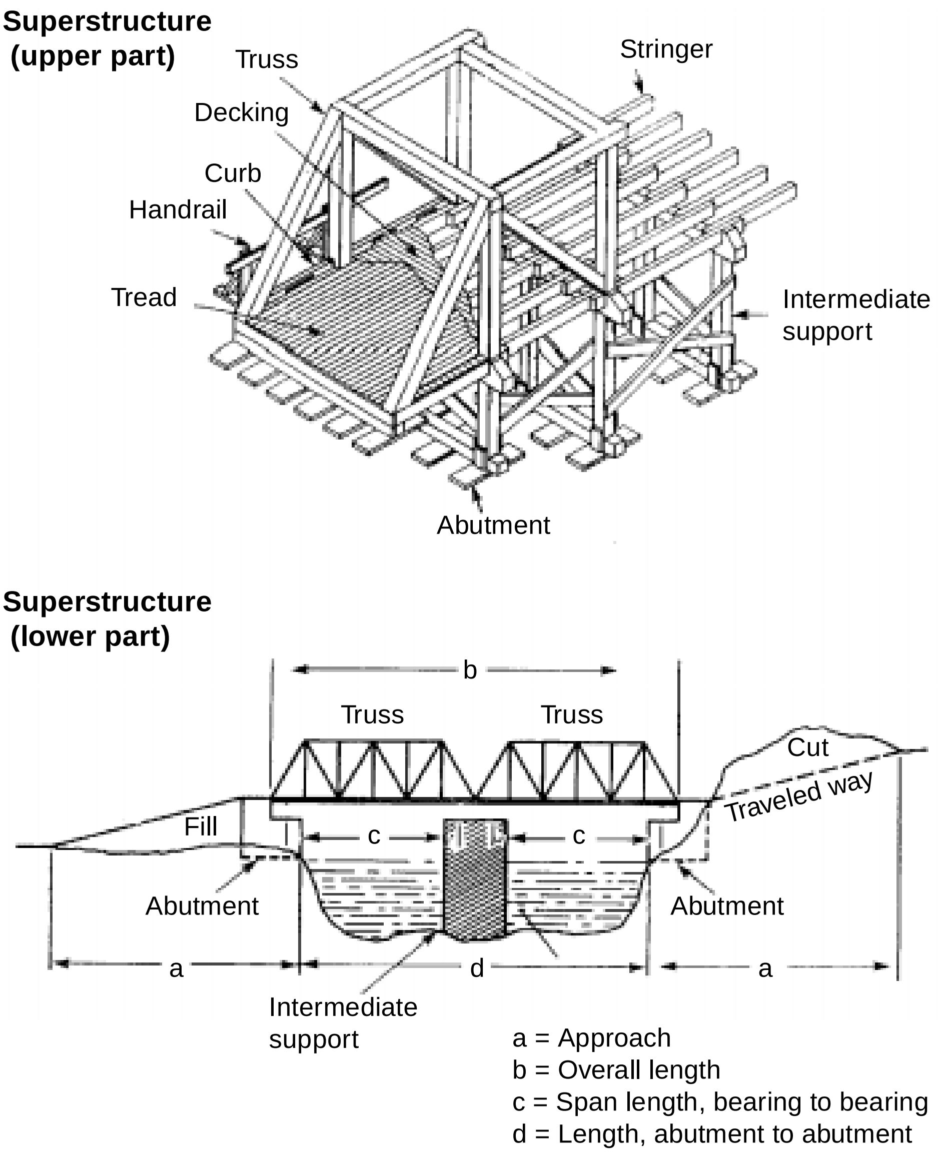


Figure 5-37. Bridge parts

— The number of members in each span is noted where applicable (for example, stringer bridges and concrete T-beam bridges). Exact dimensions of specific bridge members are taken as outlined later in this chapter.

— The span length is measured from center to center of the supports. The bridge's classification is usually based on the weakest span. If the weakest span is apparent, no other spans need to be reconned. However, if the weakest span is difficult or impossible to locate, all spans must be classified. Even if several spans look identical, actual measurements should be taken to prevent error.

— The traveled-way width is measured between the inside faces of the curbs. However, the horizontal clearance on a truss bridge is measured from a point 1.21 meters above the roadway.

BRIDGE CONDITION

It is essential to note the bridge's general condition, paying particular attention to evidence of damage from natural causes (rot, rust, and deterioration) or combat action. Classification procedures presume that a bridge is in good condition. If the bridge is in poor condition, the class obtained from mathematical computations must be reduced according to the classifier's judgment.

WIDTH AND HEIGHT RESTRICTIONS

Table 5-8 lists width restrictions for bridges. If a one-lane bridge does not meet width requirements, post a rectangular warning sign under the classification sign showing the actual clear width (see Figure 5-38, page 5-52). If this is a route restriction, annotate it in the route-classification formula. For a two-lane bridge, downgrade the two-way classification to the highest class for which it does qualify (one-way class is not affected). Post a limited-clearance sign if the overhead clearance is less than 4.3 meters. These signs must be a minimum of 40 centimeters in height or width, with a yellow background, and the appropriate description in black letters. Separate rectangular signs are used if necessary to denote width limitations, height limitations, or other technical information. The same signs are used for tunnels, if applicable.

Table 5-8. Minimum roadway widths

Roadway Width (meters)	Bridge Classification	
	One-Way	Two-Way
2.75 to 3.34	12	0
3.35 to 3.99	30	0
4 to 4.49	60	0
4.5 to 4.99	100	0
5 to 5.4	150	0
5.5 to 7.2	150	30
7.3 to 8.1	150	60
8.2 to 9.7	150	100
Over 9.8	150	150

NOTE: Minimum overhead clearance for all classes is 4.3 meters

BRIDGE TRAFFIC-CONTROL PROCEDURE

Posting standard bridge signs and other signs needed for proper and efficient traffic control across a bridge is an engineer's responsibility. Additional signs are used when it is necessary to warn vehicles that require special controls while crossing. When necessary, holding areas, turnouts for parking and unloading vehicles, and checkpoints are installed near bridges to provide the necessary control during crossings.

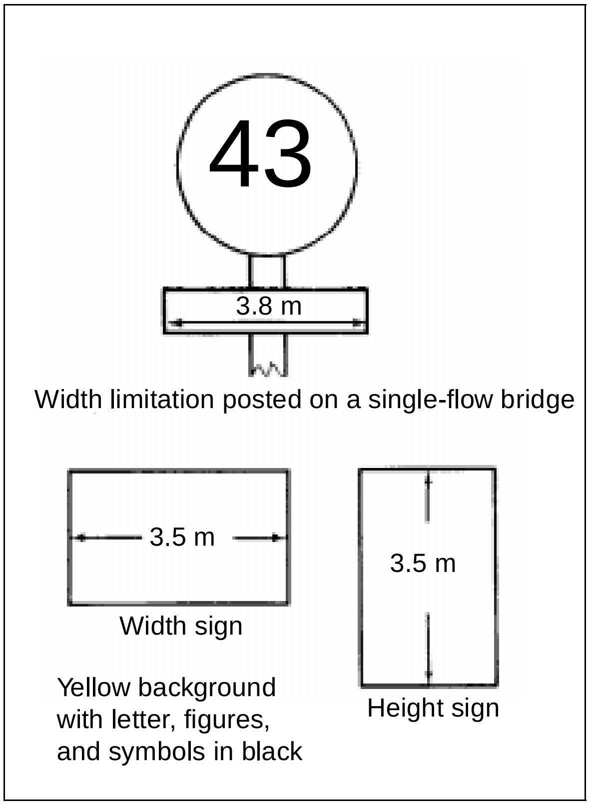


Figure 5-38. Width and height signs

FULL NORTH ATLANTIC TREATY ORGANIZATION (NATO) BRIDGE SYMBOL

Bridge information is recorded on a map or overlay by using the full NATO bridge symbol (see Figure 5-39). It is different from an on-site bridge-classification sign; do not confuse the two. The information necessary for the full bridge symbol includes the—

- Bridge's serial number.
- Geographic location.
- Bridge's MLC.
- Overall length.
- Traveled-way width.
- Overhead clearance.
- Available bypasses.

A bridge serial number is assigned for future reference and is recorded in the symbol's lower portion (assign a number according to the unit's SOP). For proper identification, do not duplicate serial numbers within any one map sheet, overlay, or document. The unit's S2 can obtain special maps containing bridge information for developed areas of the world.

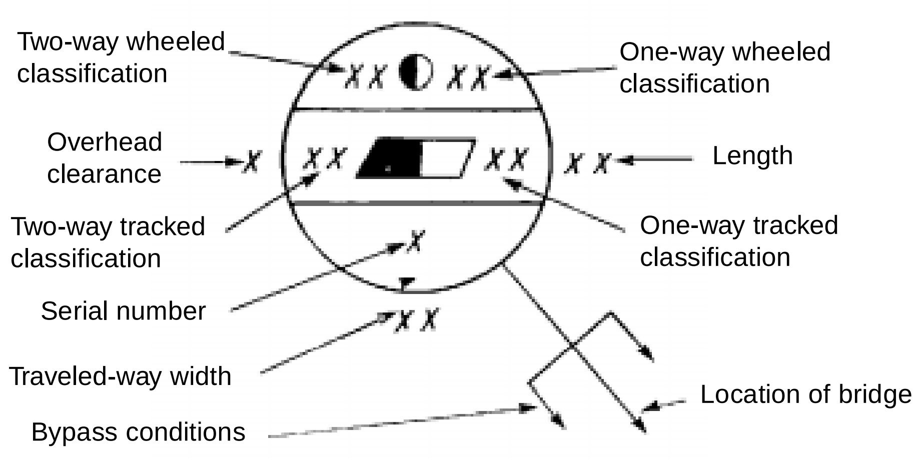


Figure 5-39. Full NATO bridge symbol

The bridge's geographic location is shown by an arrow extending from the symbol to the exact map location. The bridge's MLC number is shown in the symbol's top portion. This number indicates the bridge's carrying capacity; classifications for both single- and double-flow traffic are included. In those instances where dual classifications for wheeled and tracked vehicles exist, both classifications are shown.

The bridge's overall length is the distance between abutments, measured along the bridge's centerline. This figure is placed to the right of the circle and is expressed in meters.

The minimum lane width is the clear distance between curbs. Place this figure below the symbol and express it in meters. Bridges may be obstructions to traffic flow because the traveled-way width of the overall route may be reduced on the bridge to below the minimum standards prescribed in Table 5-1, page 5-5.

The overhead clearance is the minimum distance between the bridge's surface and any obstruction above it. This figure is shown (in meters) to the left of the symbol. Underline any overhead clearance less than the minimum required by the bridge class number (see Table 5-9, page 5-54). Unlimited overhead clearance is indicated by the symbol ∞. Often a telltale (see Figure 5-40, page 5-54) or other warning device is placed before the bridge to indicate overhead-clearance limitations. Report any overhead clearance less than 4.3 meters as an obstruction in the route-classification formula. A question mark is used to indicate information that is unknown or undetermined and is included as part of the bridge recon symbol. See Appendix E for signs used to mark roads and bridges.

Railway bridges, which could be used by road vehicles in an emergency, are indicated as use easy or use difficult. Samples of the full NATO bridge symbol used to indicate a railway bridge can be found in the glossary.

Table 5-9. Minimum overhead clearance for bridges

Bridge Classification	Minimum Overhead Clearance
Up to 70	4.5 meters
Above 70	4.5 meters

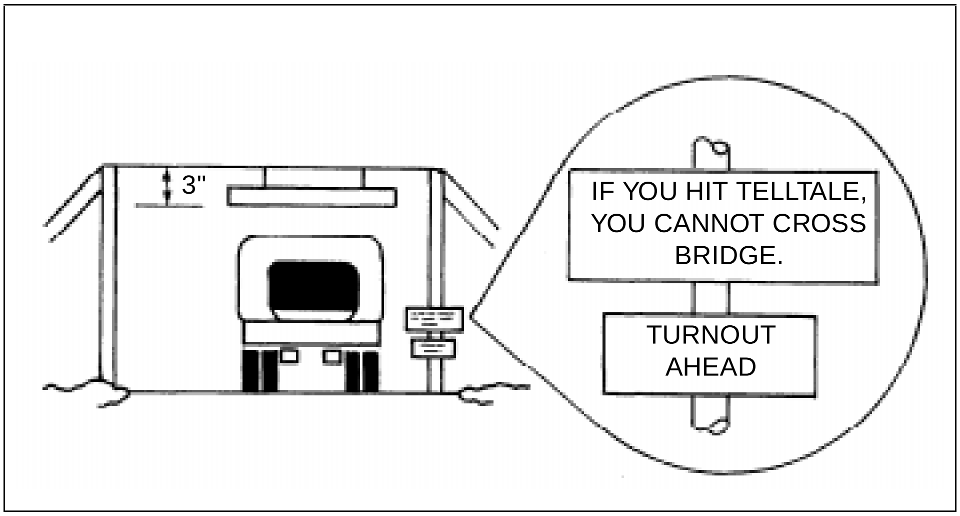


Figure 5-40. Telltale

NOTE: A railroad bridge is considered to be easy to adapt for use if it can be adapted in less than 4 hours with 35 soldiers and the appropriate resources.

THE BRIDGE RECONNAISSANCE REPORT

A systematic bridge recon obtains valuable data. However, this data will not benefit anyone unless it is recorded in an organized manner. Use DA Form 1249 to report information concerning any reconned bridge, as follows:

- **Column 1.** Record the assigned serial number. This number matches the serial number used in the bridge symbol of the route-classification overlay.
- **Column 2.** Record the grid coordinates, with the map identifier, of the actual bridge site.
- **Column 3.** Record horizontal clearance information, in meters. Horizontal clearance is the clear distance between the inside edges of the bridge structure, measured at a height of 0.3 meter above the surface of the traveled way and upwards. However, horizontal clearance for truss bridges is measured 1.21 meters above the traveled way. Any horizontal clearance less than the minimum required for the bridge's roadway width (as shown in Table 5-8, page 5-51) is underlined. Unlimited clearance is indicated by the symbol ∞.
- **Column 4.** Record under-bridge clearance, in meters. It is the clear distance between the underside of each span and the surface of the water. The height above the streambed and the height above the

estimated normal water level (pertaining to the appropriate bridge type) are included in this column for each span.

- **Column 5.** Record the number of spans. Spans are listed in sequence starting from the west. If the bridge is oriented more north to south, start with the northern most span and work south. Place the letter N in column 5 before the span and list in sequence.
- **Column 6.** Record the type of span construction. Refer to the diagrams in Figure 5-41, page 5-56, and Table 5-9 for this information.
- **Column 7.** Record the type of construction material. Refer to Table 5-10 for this information.

Table 5-10. Construction material

Material of Span Construction	Letter Symbol
Steel or other metal	a
Concrete	k
Reinforced concrete	ak
Prestressed concrete	kk
Stone or brick	p
Wood	h
Other (to be specified by name)	o

- **Column 8.** Record span length, in meters. This is a center-to-center spacing between bearings. The sum of the span length may not equal the overall length. Spans that are not usable because of damage or destruction are indicated by the pound symbol (#), placed after the dimension of the span length. Spans that are over water are indicated by placing the letter W after the dimension of the span length (see Figure 5-42, page 5-57).

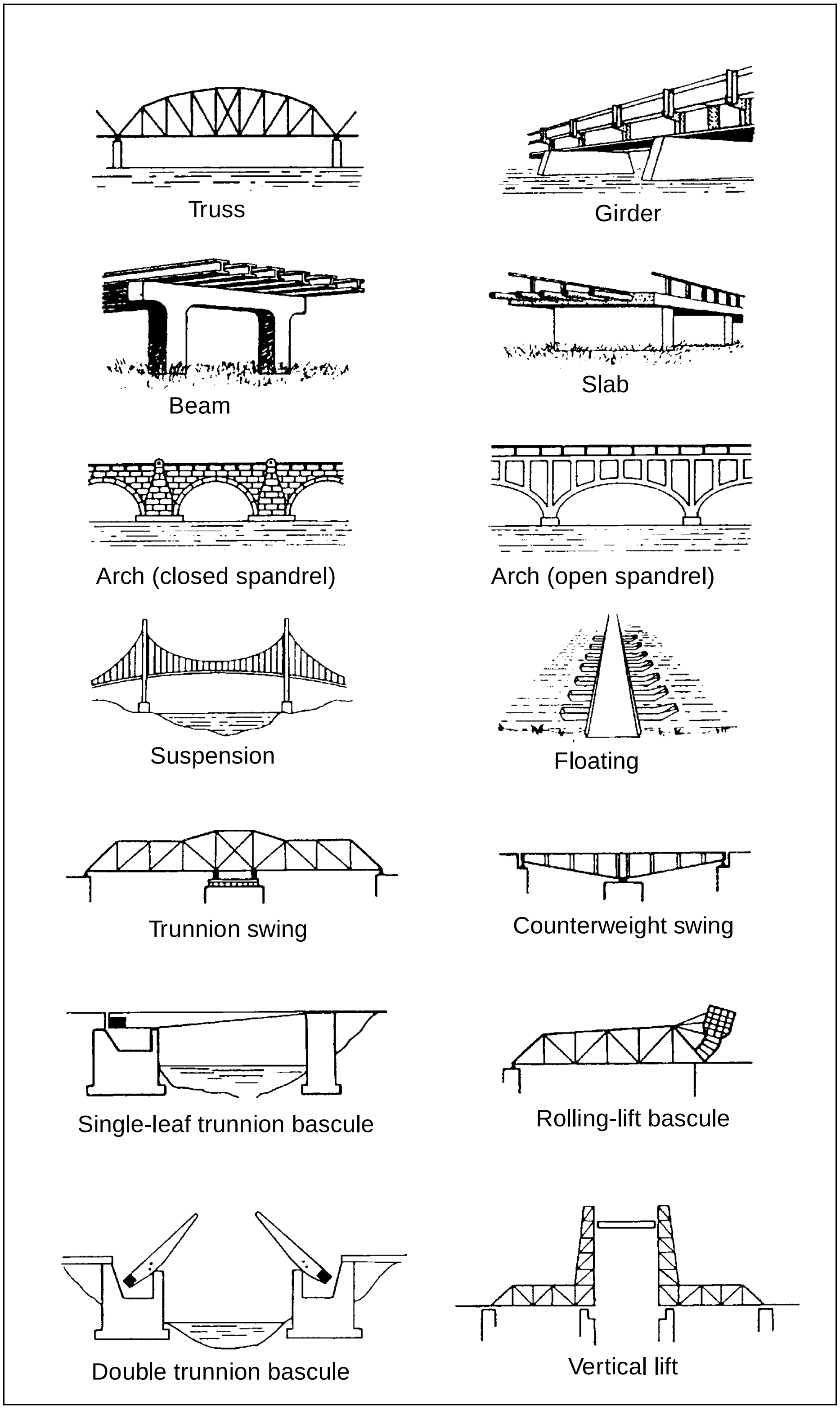


Figure 5-41. Typical bridge spans

BRIDGE RECONNAISSANCE REPORT

DATE: 27 Aug 84 | SIGNATURE: Charles Clark

TO: CDR, ATTN: S2, 21st Engr Bn

FROM: CHARLES CLARK, SGT, Co A, 21st Engr Bn

MAP: Ft Belvoir, VA SP1 12,5000 Sheet 5538 AMS 778

DATE TIME GROUP: 271930 Aug 84

ESSENTIAL BRIDGE INFORMATION								ADDITIONAL BRIDGE INFORMATION				
		CLEARANCE		SPANS								
SERIAL NO. 1	LOCATION 2	3	4	5	6	7	LENGTH AND CONDITION 8	MILITARY LOAD CLASSIFICATION	OVERALL LENGTH	TRAVELED WAY WIDTH	BYPASS POSSIBILITIES	REMARKS
1	UT 113487 29	NA	9	6	3 3 3 3 3 3	h h h h h h	14 ft (W) 15.5 ft (W) 15 ft (W) 15 ft (W) 16.5 ft (W) 15 ft (W)	16 16	90 ft	24 ft		No Handrails No Curbs

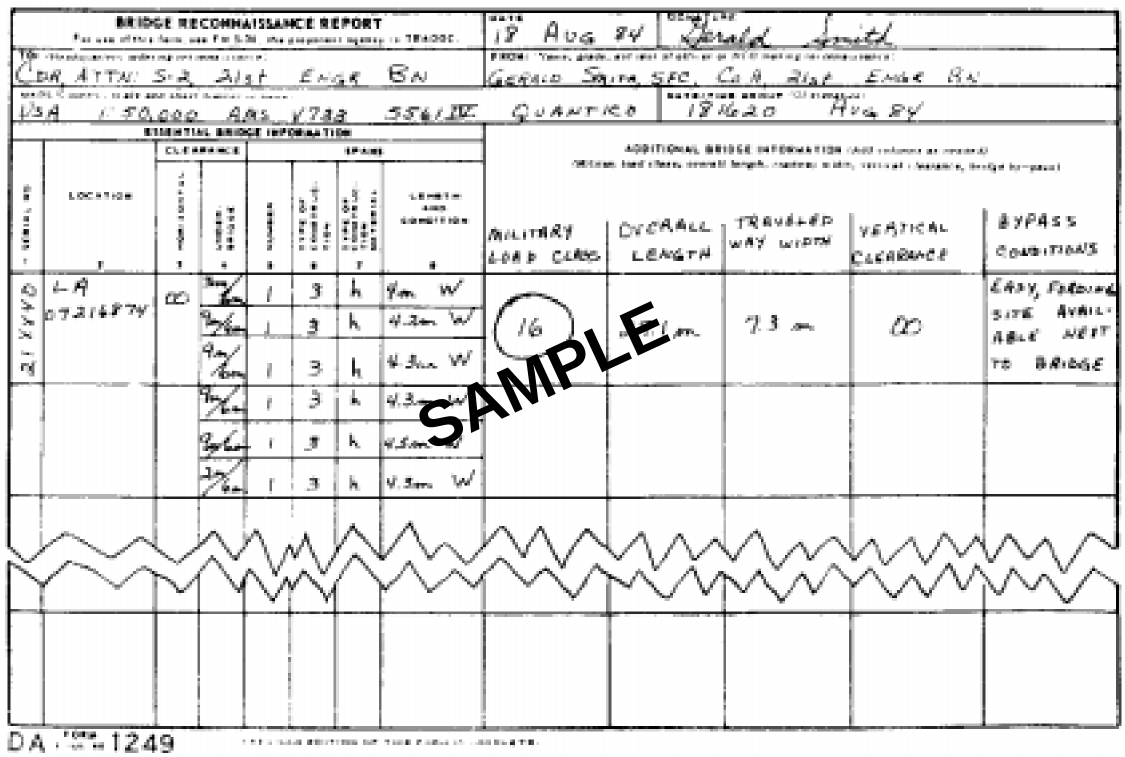
SAMPLE

DA FORM 1249 PREVIOUS EDITION OF THIS FORM IS OBSOLETE.

Figure 5-42. Sample Bridge Reconnaissance Report with full NATO symbol

OTHER INFORMATION

When an abbreviated bridge symbol is used or when a recon mission requires it, columns are added to give the MLC, overall length, roadway width, overhead clearance, and bypass possibilities (specify use easy, use difficult, or use impossible). Do not forget to indicate whether the bridge is simply supported or continuous (see Figure 5-43).



BRIDGE RECONNAISSANCE REPORT

DATE: 18 Aug 84

TO: CDR, ATTN: S-2, 21st Engr Bn

FROM: Gerald Smith, SFC, Co A, 21st Engr Bn

MAP: USA 1:50,000 AMS V733 5561 IV Quantico

DATE TIME GROUP: 181620 Aug 84

ESSENTIAL BRIDGE INFORMATION / ADDITIONAL BRIDGE INFORMATION

Serial No.	Location	Clearance: Horizontal	Clearance: Under Bridge	Spans: Number	Type of Span	Type of Material	Length and Condition	Military Load Class	Overall Length	Traveled Way Width	Vertical Clearance	Bypass Conditions
21 XXVO	LA 07216874	∞	9m/6m	1	3	h	4m W	16	[illegible] m	7.3 m	∞	Easy, fording site available next to bridge
			9m/6m	1	3	h	4.2m W					
			9m/6m	1	3	h	4.3m W					
			9m/6m	1	3	h	4.3m W					
			9m/6m	1	3	h	4.5m W					
			10m/6m	1	3	h	4.5m W					

SAMPLE

DA FORM 1249

Figure 5-43. Sample Bridge Reconnaissance Report with abbreviated bridge symbol

BRIDGE SKETCHES

Show as much information as possible when sketching the bridge on the backside of DA Form 1249 (see Figure 5-44).

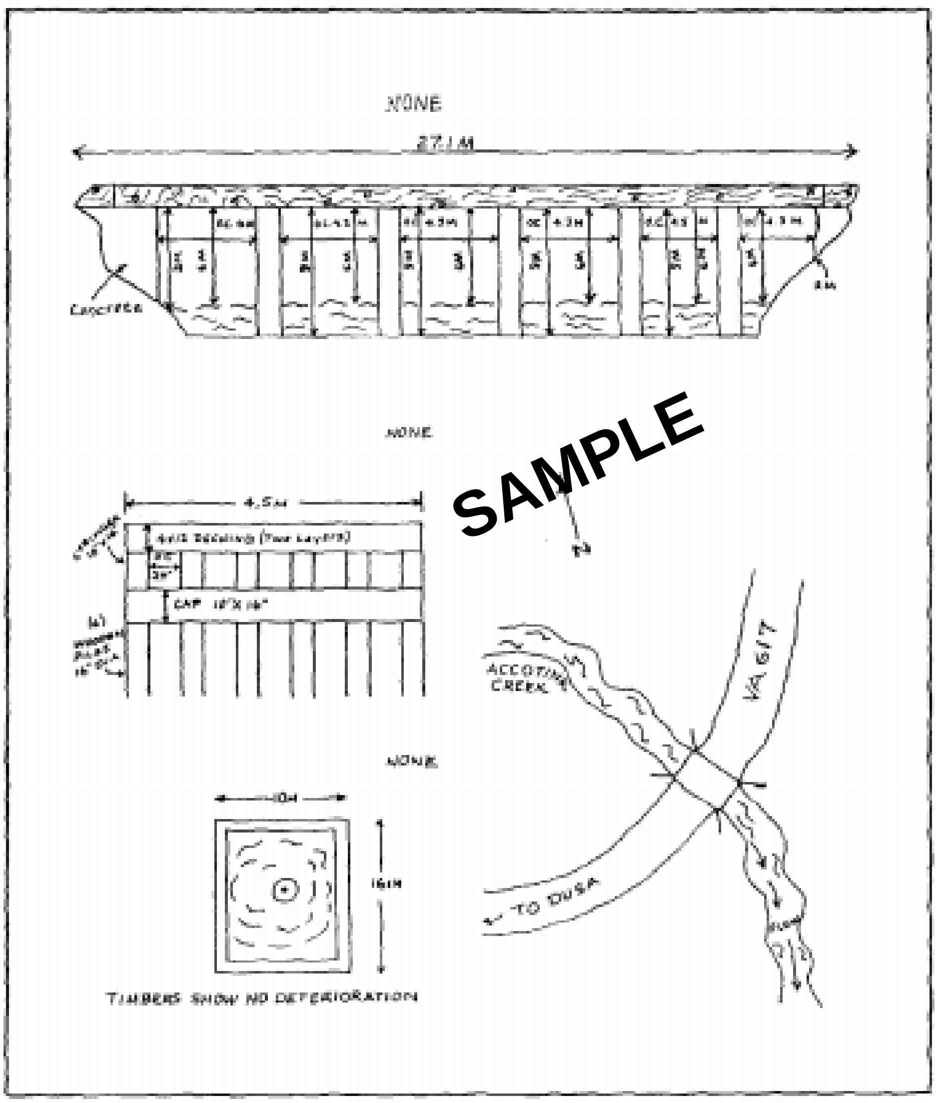
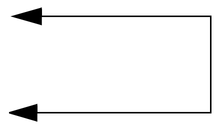
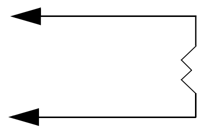
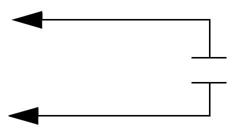


Figure 5-44. Sample bridge sketch on Bridge Reconnaissance Report

BYPASSES

Bypasses are detours along a route allowing traffic to avoid an obstruction. Bypasses limited to specific vehicle types, such as those capable of swimming or deep-water fording, are noted on the recon report. Bypasses are classified as easy, difficult, or impossible. Each type of bypass is represented symbolically on the arrow extending from the tunnel, ford, bridge, or overpass symbol to the map location (see Table 5-11).

Table 5-11. Bypass symbols

	Bypass easy. Use when the obstacle can be crossed in the immediate vicinity by a US 5-ton truck without work to improve the bypass.
	Bypass difficult. Use when the obstacle can be crossed in the immediate vicinity, but some work to improve the bypass is necessary.
	Bypass impossible. Use when the obstacle can be crossed only by repairing or constructing a feature or by detouring around the obstacle.

A bypass is considered easy when the obstacle can be crossed within the immediate vicinity by a 5-ton vehicle without work to improve the bypass. The bypass is considered difficult when the obstacle can be crossed within the immediate vicinity; however, some work is necessary to prepare the bypass (ensure that the estimation of time, troops, and equipment necessary to prepare the bypass is included on the recon report). The bypass is considered impossible when the obstacle can be crossed only by repairing the existing bridge or tunnel, building a new bridge or tunnel, or providing a detour.